The Virginia Telehealth Network Strategic Plan

Improving Access to Quality Health Care in Virginia through Information and Communication Technology:

A Strategic Plan for the Development of a Telehealth Infrastructure in the Commonwealth

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Preamble

In the 2003 *Report to the Virginia Department of Health on Improvements Needed in Current Telemedicine Initiatives and Opportunities to Enhance Access and Quality*, the authors concluded that the following recommendations were necessary "to keep Virginia moving forward":

> Implement a comprehensive and integrated statewide telemedicine/telehealth (TM/TH) infrastructure strategic planning process;
>
> Establish and communicate specific authorities and particular roles for state agencies' committees, commissions, and work groups with respect to the physical infrastructure (existing telecommunication and health care resources) within the state and functional infrastructure (administrative, bureaucratic, programmatic and political);
>
> Establish collaborative systems to ensure interoperability among entities with authority and responsibility to process data and information;
>
> Coordinate processes for data information collection, management, reporting and dissemination using standardized frameworks and tools appropriate to the task for policy and program planning within each agency; and
>
> Create a framework for evaluation of future TM/TH activities in the Commonwealth using mechanisms and elements drawn from prior evaluation frameworks described within this study.

The Virginia Telehealth Network Strategic Plan, Improving Access to Quality Health Care in Virginia through Information and Communication Technology: A Strategic Plan for the Development of a Telehealth Infrastructure in the Commonwealth (2005) builds upon the 2003 report. This Strategic Plan is meant to serve as a reference for those who will create the infrastructure on which this plan is based. It is intended to be flexible to accommodate the vagaries that accompany the implementation of public projects which seek to overcome historical obstacles that have prevented consumers from utilizing technologies to their benefit. The purpose of this Strategic Plan is to increase the health and well-being of the citizens of the Commonwealth by providing the underpinning of a

telecommunications structure to support the rapid adoption of telehealth technologies now enjoyed throughout the world

- It provides a framework for a state-wide telehealth infrastructure. It is a roadmap for technological, business, and marketing design and implementation, and a guidebook to establish a governance and management organization that will address the telehealth needs of the Commonwealth.
- It reduces three prevailing barriers to marketplace entry in using telehealth applications: (1) access to, and cost of teleconnectivity, (2) cost of equipment and maintenance, and (3) access to, and cost of technical assistance. The Plan provides for the capability of VTN end-users and subscribers to lease telecommunications connectivity, medical digital equipment, services, and technical assistance that would otherwise be cost-prohibitive if purchased or leased without the purchasing power of a state-wide organization.
- It further reduces technical barriers by providing specification, standardization and purchasing procedures to ensure interoperability throughout the Commonwealth. It provides for the eventual build-out of a ubiquitous telecommunications backbone capable of rapid response to natural disasters and man-made threats to health and security.
- It describes how a shared funding mechanism could work for regional market start-ups and first year telehealth projects. A ten-year revenue generating business plan is contained in the Plan.
- The Plan will lead the Virginia Telehealth Network to becoming a self-sustaining national service delivery model for
    - organizational stewardship,
    - management decision-making,
    - accessible and affordable telecommunications infrastructure, and
    - equipment leasing.

The VTN Strategic Plan addresses teleconnectivity, management, and technical issues surrounding the wide-spread adoption of telehealth in the Commonwealth. The scope of the VTN Strategic Plan does not cover in depth the many aspects of telehealth applications, the benefits that have been proven by their use, or the numerous private and nonprofit facilities and medical systems in Virginia that are practicing telehealth applications. Previous studies and legislative actions cited elsewhere in this Plan provide source materials for comprehensive descriptions of many telehealth initiatives in Virginia.

For example, Eastern Virginia Medical School has been providing, via microwave, professional medical education to subscribers for more than five years. Likewise, Sentara Health System has been delivering home health medical care to their patients for many years as well. During the public review/comment period from November to December 2005 many suggestions were made for inclusion in the Strategic Plan. Where possible the Strategic Plan addresses these issues and has been strengthened by the suggestions and advice of VTN members throughout the Commonwealth.

It is the intent of the authors of this document that it be considered an on-going dynamic roadmap to guide Virginia toward full implementation of the recommendations provided herein. To this end, the Strategic Plan should change as new circumstances are presented and new information is incorporated in the Plan goals, objectives, and tasks. It should be updated from time to time, as is any owner's operations manual, to reflect, in this case, the changing and volatile healthcare delivery marketplace. This Plan builds upon findings of legislative committees, departmental agencies, and academic institutions and therefore does not reiterate the work of those institutions but seeks to move those findings from the page to practical implementation.

For example, obstacles, such as reimbursement for both originating and receiving sites for medical professionals, continue to hamper the full utilization of proven telehealth care applications. Confidentiality concerns and legal liabilities continue to cause apprehension among healthcare providers who are faced with mounting malpractice insurance premiums. Many of these medical providers would otherwise apply telecommunications technologies to their medical practices if there were some assurances of legal and regulatory protections that could protect their practices from undue risk. Licensure issues for medical professionals who wish to practice across state and national jurisdictions will also need to be addressed in the future. As the infrastructure proposed in this Strategic Plan is implemented, it is the intent of the Virginia Telehealth Network to address these issues and develop workable solutions that can be implemented throughout Virginia in a timely and cost-effective manner.

The promised benefits of increasing the health of a population and providing a continuum of care by means of establishing a state-wide telehealth infrastructure have yet to be fully realized in Virginia. The Strategic Plan presents for your consideration a clear path to realizing much of that promise. Telemedicine applications in Virginia, the United States and throughout the world have proven to be cost-effective. In Virginia, several public and private medical systems, teaching hospitals, and grass-roots organizations have chosen telehealth applications to provide primary care, and to diagnose, treat, and follow-up with patients on a wide-ranging list of medical conditions and diseases. The Virginia Telehealth Network Strategic Plan appreciates the pioneering work of these organizations and provides a method in which this entrepreneurial spirit can be harnessed to transform the health of Virginia communities.

Note: Telemedicine is the use of medical information exchanged from one site to another via electronic communications to improve patients' health status

- *American Telemedicine Association website*

Examples include:

- Tele-radiology
- Tele-surgery
- Tele-pathology

Typically, the telemedicine consult utilizes television monitors and computer screens to transmit visual and audio information from originating to remote sites.

Telehealth encompasses a broader definition of remote healthcare that does not always involve clinical services. Telehealth services include a range of health care, health education, and public health related services facilitated by the use of video conferencing, imaging and other communications technologies.
Examples:

- Home health monitoring
- Bio-surveillance
- Patient translation services

Solutions addressed in the Virginia Telehealth Network Strategic Plan to potential challenges to adopting telehealth technologies.

Historically rural telemedicine applications have been slow to be adopted. The VTN Strategic Plan provides solutions for each of these historical barriers:

- ☑ Lack of broadband infrastructure
- ☑ Lack of ability to purchase equipment
- ☑ Lack of ability to pay for connectivity charges
- ☑ Lack of reimbursement agencies and third-party payers to recognize value of using telehealth applications
- ☑ Lack of access to applications by consumers
- ☑ Lack of support and training to integrate technologies into business and clinical practices
- ☑ Perceived exposure to risk and malpractice suits
- ☑ Lack of stand-alone organizations to possess the expertise to install and maintain equipment
- ☑ The immediate need to just treat chronically underserved patients
- ☑ Perceived dubious value of investing in unproven technology investments over direct "primary care"
- ☑ Lack of organizational cohesiveness of grass-roots efforts when grant funding expires

For a synopsis on persistent reimbursement and licensure issues, please see Appendix B for Virginia Legislative Actions on this aspect of obstacles to adopting telehealth applications. The reader can also access full documents regarding telehealth initiatives and studies outside the scope of this document on the Virginia Department of Health website for Primary Care, Office of Health Policy and Planning. The Virginia Telehealth Network can be found by browsing www.vdh.state.va.us/.

Improving Access to Quality Health Care in Virginia through Information and Communication Technology:

A Strategic Plan for the Development of a Telehealth Infrastructure in the Commonwealth

Executive Summary

Introduction/Background

This Strategic Plan reflects the thinking of over 80 individuals representing 50 public and private agencies and organizations who make up the Virginia Telehealth Network (VTN). It also represents more than three years of leadership by the Virginia Department of Health Office of Health Policy and Planning (VDH) that began in November 2002 with an informal gathering of just over 20 individuals. In the three years to follow, a telehealth site survey was conducted to assess the capacity, future needs, and weaknesses of the existing infrastructure; a white paper was developed by the VTN Infrastructure Work Group recommending the development of a statewide telehealth network; and considerable input regarding the needs and barriers to telehealth in rural Virginia, and the desired network architecture and design to meet the present and future needs of all VTN members, was obtained from the approximately 100 participants who took part in the VTN Consensus Conference held in Natural Bridge, Virginia in May 2005.

Statement of Need

The time is right to establish a statewide telehealth network. The need is considerable:

- Health disparities continue to exist. Underinsured and underserved citizens have historically been concentrated in rural areas and in urban pockets of Virginia. Increasing access to preventive, primary, and specialty care for citizens in these underserved areas will bring a greater parity of services. Not only reducing disparities due the health care access reduce the burden of the rising cost of health care for all Virginians, but it will also result in a healthier workforce, thereby enhancing the potential for economic development and growth in these often economically depressed areas.

- There is a growing demand for emergency preparedness. This is due, in part, to recent events and emergent public health threats such as those related to bioterrorism and homeland security, influenza pandemics, and natural disasters. Virginians now expect responses to emergencies to be rapid/timely and humane, regardless of geographic and distance barriers.

- Virginians with physical, emotional, and cognitive disabilities are increasingly finding a voice. Those who have limitations of daily activities, mental health and substance abuse problems, those who are aging in place, and those who are medically eligible for home health monitoring, will increasingly demand parity of services and range of treatments that are otherwise available only in urban and

suburban Virginia.

- A growing population of older citizens, pre and post retirement age, lives in Virginia. As aging baby-boomers reach retirement age and beyond, the demand for continuity of healthcare delivery and support services will outstrip the existing healthcare delivery system in the Commonwealth. Access to the most appropriate level of healthcare, regardless of geographic barriers or travel distance, can address four areas of concern for this burgeoning population:

The Vision and Plan

In September 2005, a Strategic Plan Task Force was formed and charged with developing a plan to establish a statewide telehealth communications infrastructure. Telehealth applications for purposes of this document do not address electronic health records (EHRs), a master patient index (MPI) or health related databases and health data gathering and dissemination. For a full discussion on EHRs, MPIs, and healthcare database formulations, please see the Interim Report: Governor's Task Force on Information Technology in Health Care, November 1, 2005 http://www.ehealth.vi.virginia.gov/. However, this plan complements the Governor's Task Force Report in several ways, and the VTN anticipates working with the Governor's Task Force on Information Technology in Health Care to ensure that the Virginia telecommunications infrastructure for telehealth is ubiquitous and can accommodate the recommendations in the Governor's Task Force report.

This VTN Strategic Plan is intended to serve as a roadmap, providing specifications for the desired architecture, establishing a business case for funding and future self sustainability, and identifying a structure for governance and oversight. The statewide telehealth network, as detailed in this document, will be accessible within every region, health care market, and community in the Commonwealth, starting in medically underserved rural areas (MUAs); health professional shortage areas (HPSAs); communities with high disease and chronic health condition disparities; and communities that demonstrate a "readiness for deployment". The network will utilize the existing telecommunication infrastructure established by telephone, cable, cellular, microwave, and satellite communications companies. The network will provide members with the capability to disseminate health education information, provide clinical consultations by employing video and/or image and/or telephone conferencing, and employ home health monitoring with any other member of the network. The network has been designed to adhere to the following member-defined guiding principles:

- Robustness
  Allowing for simultaneous voice, video, imaging and data sessions;
- Cost Effectiveness
  Utilizing modern telecommunication technology and existing wire, fiber optic and wireless telecommunications circuits;
- Ease of Use
  Using standard off the self equipment including PCs, hand-held personal assistant (PDA) and other equipment;

- Manageability
  Using a centralized management approach and Help Desk to oversee the entire operation on a daily basis and also support lease equipment;
- Reliability
  Using quality name brand equipment with high operational availability rates, and existing telecommunication lines and systems;
- Dependability
  Using multiple paths both on the backbone and access to remote communities where possible;
- Scalability
  Allowing for flexibility of design to handle small, large, and growing areas;
- Maintainability
  Using standards based equipment with maximum warranty periods, technology refreshment as life cycle and technology advancement, remote monitoring and diagnostics software from the centralized management Help Desk and outsourcing on-site maintenance when and if needed;
- Capability
  Linking other network nodes to the VTN within and outside the state;
- Accessibility
  Facilitate telehealth over a private network through direct connection, virtual private network, the public Internet or, dial-up connections;
- Sustainability
  Raise income through a variety of revenue generating services, leasing of equipment and broadband facilities leasing;
- Security
  Using 128 Bit security encryption, the highest available security on commercial market

Recommendations for Implementation

The following recommendations for Virginia are being put forth in this plan:

1. Establish a nonprofit corporation to implement the Strategic Plan for the Virginia Telehealth Network Infrastructure.

   - Recommend VTN governance begins with volunteer representation by VTN end-users and interested parties; and transition to a representative Board of end-users within 12 months.

   - Recommend retention of select Task Force members and hired contractors for VTN management team to maintain continuity through first two years' planning, marketing, start-up, transition, evaluation and reporting periods.

2. Utilize regional health needs and readiness criteria to affect a phased regional roll-out of services to deploy telehealth applications.

    - Recommend implementation of a pilot project in the Northern Neck and Middle Peninsula region through the Northern Neck Middle Peninsula Telemedicine Consortium.

    - Recommend VTN identify another rural region in Virginia that meets health needs and readiness criteria for second demonstration project to be implemented within 12 months of first project—projected additional 33 site connections.

3. Develop the VTN as a self-sustaining flexible, scalable, secure, and cost-effective network infrastructure capable of electronically linking all communities within Virginia.

    - Recommend VTN revenues collected during first two years of start-up and operation be used to cover the necessary costs for additional deployment of telehealth applications at specific sites throughout regions of Virginia.

4. Provide rural hospitals, clinics, medical practices, mental health, and social services providers the technical assistance and financial backing to pay for the first two years of leases for telehealth equipment, including home health monitoring and digital medical systems.

    - Recommend the General Assembly, through a one-time appropriation to help reduce the barriers to entry and provide a new revenue source for rural healthcare facilities, fund the first two years telehealth network implementation costs.

5. Appropriate state monies to (a) provide operational expenses for the VTN and to implement the two pilot projects included in the Strategic Plan in FY07 and FY08, and (b) leverage an estimated Rural Utility Services (RUS) loan/grant of $1.8 million.

    - Recommend state appropriation of $840,203 for Year 1, and $1,294,853 for Year 2 for VTN start-up and operations. Total appropriation: $2,135,056.

Note: The Rural Utilities Service (RUS) has expressed an interest in supporting this project, but may only provide support for rural areas. This means that the RUS funds can only be used to support health services in designated rural areas according to federal regulations governing the RUS Grant/Loan Program. The VTN Strategic Plan Task Force is investigating other funding resources that could support telehealth applications for Virginia's urban population.

Sustainability/Business Plan
The following table delineates transmission costs, staffing, teleconnectivity (into the Network), and equipment lease costs for the first two years of state appropriations, after which the VTN will be self-sustainable.

First & Second Year Number of Sites and Associated Costs

	Number Of Sites	Year One	Number Of Sites	Year Two
Rural Cost	10	$106,000	20	$272,000
Salaries		$536,373		$739,023
Operational Cost		$20,000		$10,000
Local Loop	10	$96,000	20	$192,000
Equipment Lease	7	$81,830	11	$81,830
	Total	**$840,203**		**$1,294,853**

TOTAL $2,135,056 (Years 1 & 2)

First Year Salaries (not eligible for RUS funding) are for the following:

- Manager
- 50% Billing/Account Receivable
- Sale/Customer support specialist
- Marketing Support Specialist
- Senior Service and Operations Manager
- Senior IT Systems Engineer
- Ops/Site Technician

Second Year Salaries (not eligible for RUS funding) are for the following:

- Manager
- 50% Admin/Analyst
- Billing/Account Receivable
- Sale/Customer support specialist
- Marketing Support Specialist
- Senior Service and Operations Manager
- Senior IT Systems Engineer
- Ops/Site Technician

The regions selected for roll-out in the first two years will be determined by health care needs and readiness for implementation. The region chosen for Phase 1 roll-out (considered to be a pilot project) will begin paying subscriber and service fees after the first year of operations. Regions subsequently chosen for roll-out will begin paying subscriber and service fees after the second year of operations. Phases for regional roll-out are expected to take about 12 months to ensure deployment, implementation, and operations are established according to the Strategic Plan.

The following timeline and table illustrates the mechanism for funding the implementation of the VTN Strategic Plan.

Year 1 Phase 1 roll-out to Region 1.
Funding Sources: General Assembly and Rural Utilities Services (RUS) Grant/Loan Program

Year 2 Phase 2 roll-out to Region 2.
Funding Sources: General Assembly, Region 1 through subscriber and services fees to VTN, and Rural Utilities Services (RUS) Grant/Loan Program

Year 3 Phase 3 roll-out to Region 3.
Funding Sources: Region 1 and 2 through subscriber and services fees to VTN and RUS Grant/Loan, USF cost recovery to Region 1

Year 4 Phase 4 roll-out to Region 4.
Funding Sources: Regions 1, 2 and 3 through subscriber and services fees to VTN and RUS Grant/Loan, USF cost recovery to Regions 1 and 2

Year 5 Phase 5 roll-out to Region 5.
Funding Sources: Regions 1, 2, 3 and 4 through subscriber and services fees to VTN.

Year 6 Phase 6 roll-out to Region 6. Funding Sources: Regions 1-5 through subscriber and services fees to VTN. See chart below.

How funding and fees work together to ensure two-year self-sustainability cycles:

	Fiscal	Year &	Region	1	2	3	4	5	6	7	8	9
Funding Source												
	General Assembly			X	X							
	RUS			X	X	X	X	X	X	X	X	X
	VTN					X	X	X	X	X	X	X
	Region 1			*	X	X	X	X	X	X	X	X
		USF				+	+	+	+	+	+	+
	Region 2				*	X	X	X	X	X	X	X
		USF					+	+	+	+	+	+
	Region 3					*	X	X	X	X	X	X
		USF						+	+	+	+	+
	Region 4						*	X	X	X	X	X
		USF							+	+	+	+

* = Deployment & Operations with ½ year Active; X = Year Regional Service Fee is Active; + = USF Cost Recovery

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Introduction

The patchwork organization and the patchwork funding of the [healthcare] safety net vary widely from community to community, and the availability of care for the uninsured and other vulnerable populations increasingly depends on where they live.
The Institute of Medicine [IOM], 2000

Geography should not dictate the health of a community; however, physical barriers to healthcare greatly impact longevity and the quality of life in rural areas of Virginia. Overcoming the challenges of geography and distance to provide Virginians access to the full range of available healthcare services and medical expertise requires the use of technology to electronically link the healthcare delivery system to its patients.

The Virginia Telehealth Network

An informal gathering of individuals involved in telehealth in Virginia took place in November 2002. Over 20 individuals representing 14 private and public agencies and organizations were in attendance. These individuals found that they had common goals and experienced similar challenges...hence the birth of the Virginia Telehealth Network (VTN).

The VTN is facilitated by the Virginia Department of Health (VDH) and is composed of a voluntary coalition of Virginia healthcare providers, technology vendors, agency representatives, consumers, and telehealth end-users. The VTN presently has a membership of more than 80 individuals representing 50 public and private agencies and organizations. The VTN meets three times per year and has formed several smaller workgroups, one of which has been focused on infrastructure issues. Since 2003 the VTN has met to investigate healthcare delivery problems that could be addressed using telehealth applications. The integration of telemedicine/telehealth applications into medical practice has proven to be cost effective in providing continuity of care for patients and support for their families.

Telehealth applications include:

- primary and specialty care
- professional and public health education
- disease detection and prevention
- chronic care monitoring
- bio-surveillance

Outcome of May 2005 Consensus Conference

In May 2005, a Consensus Conference sponsored by the VDH in conjunction with the Virginia Rural Health Association/Virginia Rural Health Resource Center, the University of Virginia Health System Office Of Telemedicine, and the Edward Via Virginia College of Osteopathic Medicine, was held to determine the healthcare needs of rural Virginians. The conference participants recommended creating a Task Force to develop a strategic plan for rural telehealth before the end of the 2005 calendar year that would:

- Establish a statewide telecommunications network infrastructure to provide healthcare access to all underserved and underinsured Virginians.
- Provide the means to implement a statewide advanced telecommunications infrastructure

In September 2005 a Task Force was formed and charged with developing a strategic plan for VTN adoption. The following goals were adopted for the plan:

Primary

1. Establish a statewide telehealth network infrastructure to enhance healthcare delivery with priority and emphasis on medically underserved regions using telehealth/telemedicine technologies.

2. Increase access to medical specialty services while decreasing healthcare costs.

3. Encourage healthcare professionals to establish primary care practices in underserved rural areas by using telehealth outreach programs.

4. Provide the means to obtain information and training for healthcare workers, medical professionals, and patient education for residents of the Commonwealth in medically underserved areas.

5. Provide healthcare organizations and providers with information, training, and technical assistance to rapidly adopt telehealth technologies for patient treatment.

Secondary

6. Position the telehealth network to function as a test bed for state and federal agencies for the evaluation of telehealth/telemedicine services.

7. Increase and promote the use of distance learning in public health and medical care.

8. Evaluate telehealth/telemedicine equipment, applications, and telecommunications options and insure the compatibility and interoperability of use among end-users.

9. Position the telehealth network to interface with regional and national telehealth initiatives.

The Strategic Plan

- addresses issues regarding the level of design specificity for a phased regional roll-out of telecommunications services based on community health needs and readiness to deploy.
    - Health needs criteria include state and federal designated Health Professional Shortage Areas and Medically Underserved Areas, regions with high disparities of diseases and chronic conditions as compared with Virginia and the United States.
    - Readiness criteria includes facilities and providers who are capable of signing binding contracts for leasing equipment and services, for accepting grants, and for entering into legal and binding contracts that include requirements for debt servicing federal, state, and private loans.
- provides a clear description of levels of functionality and features of the Network.
- includes a cogent business case for support and adoption by the legislature.
- can be considered the source document by policy analysts, lawmakers, and potential funders of the VTN organization and the telehealth Network.
- can be compared favorably with other state strategic plans and be considered a national model for purposes of planning, design, implementation, and operation.
- provides the appropriate information from which to build, maintain, finance and govern the Network. It will be "actionable".

Plan Criteria

The Plan addresses network

- telecommunications, teleconnectivity, and infrastructure funding
- scheduling and utilization
- growth, re-engineering, and scalability
- quality and reliability
- financial underpinning and maintainability
- deployment criteria for phased regional network implementation
- flexibility to allow for changing circumstances
- support for projected stakeholders including technical assistance, equipment maintenance, and a customer service call center
- business and marketing strategies

Services Revenue

- Access
  - By speed and
  - By type
- Video Bridging
- VoIP Bridging (future)
- Web Conferencing
- Group purchasing and leasing of medical digital equipment
- Tele-home Health Care
- Grant Support
- Universal access support
- And other value-added services

Management Functions

- Finance
  - Pricing
  - Billing and collection
- Engineering
  - Design of backbone
  - Project Management
  - Network Management
  - Customer support and design
- Sales and Marketing and Fund-raising
  - Design Telehealth applications
  - Market VTN services
- Direction of VTN and Coordination of Strategic Plan elements

Background

Infrastructure Work Group

During the fall of 2003, the VTN, under the sponsorship of the VDH, established an Infrastructure Work Group (IWG) to examine current telehealth capabilities in Virginia and identify future requirements. The IWG conducted a survey to examine the adoption and status of telehealth utilization by health care facilities participating in the VTN. The survey investigated telehealth network capacity and future plans for utilizing telehealth applications. (See Appendix A for further survey information)

Survey Findings:

Key issues were identified.

- Respondents were very interested in identifying ways to offset the cost of telehealth technology. Financial sustainability should be a requirement for developing telehealth strategic plans.
- Service quality should be ensured in order to maintain the "usability" of telehealth applications. Network planners should make certain that capacity and appropriate technology standards are in place to ensure service quality. For example, several of the larger networked sites used video conferencing over Internet Protocol (IP) without Quality of Service (QoS) protocol. Without QoS, the quality of a video-conference could be compromised during times of network congestion.
- Scheduling of video-conferences posed a significant logistical barrier to video-conferencing in clinical settings. The implementation of interoperable network scheduling system(s) could reduce this barrier.
- Lack of connectivity at remote locations was a barrier to designing a geographically inclusive network. The VTN should identify alternative access methods for multi-point on-demand (any-to-any) connectivity to ensure universal access to the network.
- Network interoperability was of prime concern. Different technology standards and policies hindered interconnectivity.

See Appendix A for a comprehensive discussion of Virginia Telehealth Network planning and activities.

History and Legislative Actions

History

Telehealth in Virginia began in the early 1990s. The University of Virginia is credited with being the leader in Virginia's telemedicine movement. Virginia Commonwealth University has been involved in telemedicine activities since 1995. Mental health specialists began utilizing Telehealth in 1995 to deliver telepsychiatry services in far southwest Virginia. In August 2003 the Edward Via Virginia College of Osteopathic Medicine (VCOM) opened in Blacksburg, Virginia. VCOM is providing connectivity to hospitals throughout southwest Virginia, which serve as clinical rotation sites for third and fourth year medical students. The Northern Neck Middle Peninsula Telemedicine Consortium was formed in September 2004 to promote the use of telemedicine applications throughout the Northern Neck and Middle Peninsula region of Virginia.

UVA

Most recently, the UVA Office of Telemedicine has been involved in several new initiatives, including participation in the Remote Area Medical Clinic (RAM) in Wise County and the Martinsville health and dental fair. At both events, UVA's Office of Telemedicine connected to specialists in Charlottesville that were not available on site during the events. In addition to these state-wide events, UVA has provided telehealth services across the nation and beyond. In 2003, they participated in a nation-wide event called, "Shadow Bowl 2003." The event occurred over the 2003 Super Bowl weekend in San Diego, California and simulated a mass casualty event. The local first responders and on-site medical personnel requested assistance nationwide. During the event UVA's Office of Telemedicine connected the UVA Emergency Department to the triage area so that UVA doctors could assist with triage of "patients' and recommend treatment. In May 2004, UVA's Office of Telemedicine participated in a multi-state Bioterrorism exercise sponsored by the Southern Governor's Association. Telehealth technology was utilized to diagnose a case of small pox and to plan a public health response. Representatives from Florida, Missouri, Kentucky, Virginia, and the Center for Disease Control and Prevention participated in the event. Most recently, the Office of Telemedicine, in partnership with Freedom Calls Foundation, connected to soldiers serving in Camp Cooke, Iraq. Through live videoconferencing, a local mother connected to her son. Other service members have connected with their families through multi-point videoconferencing.

VCU

VCU continues to provide Telehealth services to approximately sixteen (16) prison sites. Inmates go to the hub site were the telemedicine equipment is located. VCU is currently providing care through telemedicine to approximately 400 HIV infected inmates statewide. They also provide pre-and post-operative services to patients who have had orthopedic, oral surgery, and general surgery. In addition, VCU provides renal and cardiac services over telemedicine. The current telemedicine program provides approximately 150-175 consults per month. VCU has been working on TOLD (Telecollaboration OnLine Database), a new web-based international telemedicine program in association with MITAC, the Medical Informatics and Technology Applications Consortium, funded by NASA. VCU is in the process of implementing Telehealth care for the rural population in

Kilmarnock, Virginia. They plan to provide both inpatient and outpatient services. VCU also uses electronic educational tools for their INOVA program, which provides interpretation services for limited English proficiency patients.

Appal-Link

In September 2000, Salem Veterans Administration Medical Center (VAMC) became a partner with the **Appal-Link Project** to establish a telepsychiatry clinic for veterans. The psychiatrist at the Salem VAMC provides outpatient mental health services to eligible veterans in the Cumberland Mountain Community Services service area. A nurse at the Cumberland Mountain Community Services site facilitates the telepsychiatry link to Salem. The Veterans Administration estimated that as many as four hundred veterans in southwest Virginia could participate in this project. This extends outpatient mental health care into the veteran's home region and eliminates the need for travel to Salem for mental health services**.** The VA Medical Center in Salem, Virginia reports that they are still utilizing telepsychiatry for their patients at a remote clinic in Tazewell, Virginia. The consults are scheduled once a week. There have been recent discussions about expanding the VA clinic in Axton, as increased emphasis has been placed on ~~(~~community-based outpatient clinic~~)~~ services.

Edward Via Virginia College of Osteopathic Medicine (VCOM)

VCOM opened in August 2003 in Blacksburg, Virginia. VCOM is in the process of establishing an extensive Telehealth network throughout southwest Virginia. The VCOM program is a broad health education program, delivered by physicians to patient groups. The system allows faculty members in Blacksburg to connect to clinical rotations sites, called "Council of Teaching Hospitals", through southwest and southside Virginia and deliver both continuing medical education and patient education. Physicians interact with both patients and health care providers in the college's service area. Programs are delivered to students, health care providers, groups of patients, and/or family members. Educational programs are underway for health literacy, obesity management through group therapy, diabetes education, and children with special health care needs. In the fall of 2005 seven hospitals were connected, with plans underway to expand the connectivity to a total of twelve (12) southwest Virginia hospitals in the immediate future.

Northern Neck Middle Peninsula Telemedicine Consortium (NNMPTC)

The NNMPTC consists of 12 healthcare providers and facility members. There are six sites that have telehealth capabilities (Three Rivers Health District, Warsaw; Riverside Tappahannock Hospital, Tappahannock; Rappahannock General Hospital; Kilmarnock, UVA Telemedicine Department, Charlottesville; VCU Telemedicine Program, Richmond; and the Middle Peninsula Northern Neck Community Services Board, Saluda). Bay Aging, Colonial Beach will have telemedicine capabilities in the near future.

Please see Appendix B for a more detailed look at Virginia telehealth initiatives.

Legislative Actions

Virginia's General Assembly has directed several state agencies to conduct a number of studies related to telehealth services. The first study was authorized in 1995. The "**Report of the Joint Commission on Health Care: Study of Telemedicine Pursuant to HJR 455 of 1995, House Document No. 6, 1996**," concluded that cost-benefit analysis was difficult with telehealth, especially considering its use by the uninsured, and the lack of reimbursement, which constrained telehealth development. The report recommended that the Commonwealth review and consider a variety of ways to support the continued growth and evaluation of telehealth development.

The next study, "**Report of the Council of Information Management: Reimbursement for Telemedicine Services, House Document No. 51, 1997**" requested the Secretaries of Administration, and Health and Human Resources to develop a policy for consideration of reimbursement for telehealth services by state health programs, namely the Virginia Medicaid program and the Employee Health Benefit Program. The report concluded that health care payers did not support a policy of reimbursement for telehealth services; however, telehealth was believed to offer significant potential benefits to the Commonwealth's population and it felt that state efforts to evaluate and encourage telehealth pilot projects merited continuation.

The "**Report of the Council on Information Management: Barriers to the Implementation of Telemedicine in Virginia, House Document No. 31, 1997**" identified lack of reimbursement, lack of community physician acceptance, and confidentiality, as well as licensing and credentialing issues and malpractice liability, as the most important barriers to expansion of telehealth.

Additional studies identified reimbursement as a barrier to the expansion of telehealth services. The "**Report of the Joint Commission on Health Care, Study of Reimbursement and Quality of Care Issues Regarding Telemedicine Pursuant to HJR 210, House Document No. 48, 1999**," found that reimbursement was an obstacle to growth. The authority for the study was derived from recommendations in the report that suggested the Commissioner of Health should play a greater role in monitoring the state's commitment and progress in telehealth, including assessments of the three local telehealth programs sponsored by the Virginia Department of Health.

Pursuant to the 1999 Virginia Acts of Assembly Chapter 935 Item 355, the "**Virginia Department of Medical Assistance Services (DMAS) Telemedicine Report, Study of Reimbursement and Quality of Care Issues Regarding Telemedicine Pursuant to JFR 210, House Document No. 48, 1999**" required DMAS to evaluate current Medicaid reimbursement for telehealth, to develop protocols for telehealth services and to identify additional services appropriate for telehealth reimbursement. DMAS concluded that telehealth had significant potential to improve access to services, but changes in reimbursement should be approached cautiously pending further evaluation.

The "**Report of the Secretary of Technology: A Joint Study to Establish Guidelines for Ensuring Compatibility among Telemedicine Equipment, House Document No. 18, 2000**" was agreed to by the Virginia General Assembly through House Joint Resolution 683 (HJR 683) in February 1999. The HJR called for the Secretary of Technology, in cooperation with the Secretary of Health and Human Resources and other state agencies and organizations, to develop guidelines to ensure compatibility, where possible, among the equipment purchased by state agencies and others involved in telehealth. The Secretary of Technology assigned the Department of Technology Planning (DTP) to conduct the study. The DTP was formerly the Council on Information Management. DTP was assigned the role of Study Team Leader. Invitations were extended to twenty (20) organizations for an organizational meeting held on August 5, 1999. This meeting was to form a Study Team to initiate work on a report to meet the mandate of HJR 683. In addition to the charge of HJR 683, the Study Team addressed other topics. Based on the consensus of those at the organizational meeting, the topics to be covered were to be of a wider scope than the original charge of HJR 683 and were included in the Study Report. The additional topics included:

- The need to develop guidelines that would ensure compatibility among telehealth equipment operated by state agencies and other affected entities;
- The need for a "catalog" of telehealth projects or programs throughout the Commonwealth;
- The need for a greatly improved communication mechanism for dialogs among practitioners of, and parties interested in, telehealth projects;
- The need to establish and maintain a listing of existing technical standards in telehealth telecommunications, with related hardware and software standards;
- The need to determine telehealth functional standards, i.e., which bandwidth is best suited for a particular service or mode of operation; and
- The need to reduce redundant or overlapping telehealth efforts. Many agencies and departments are pursuing the same or similar objectives. Statewide contracts for telehealth related hardware and software were also a priority, with inter-operability of such hardware and software being an essential requirement.

After reviewing the use of technology to support telehealth, it was determined that existing standards were sufficient to support telehealth initiatives. Improvements in application standards for specific applications were recommended. One of the Study's recommendations suggested a comprehensive analysis be made of telehealth costs and benefits in order to quantify the benefits of telehealth programs in the Commonwealth.

The "**Virginia Department of Health Telemedicine Study Pursuant to Senate Bill 1214 (1999) and Budget Item 333 j, October 1999, Senate Document No. 18, 2000,**" was the first report of the Telemedicine Study (Senate Document 18, 2000) which summarized telehealth initiatives in the Commonwealth, recommended evaluative strategies for the study and presented the preliminary findings.

The most comprehensive study on telehealth initiatives was conducted by the VDH. The "**Report of the Virginia Department of Health: Report on Telemedicine**

Initiatives, Senate Document No. 28, 2001", was a consensus of the money committees and the Joint Commission on Health Care to combine the language and intentions of both Senate Bill 1214 and Item 333 j of the 1999 Appropriation Act. The study focused primarily on clinical applications of telehealth rather than video conferencing and distance learning. Four primary barriers that confront telehealth programs in Virginia were identified:

- Lack of adequate reimbursement and financing;
- Technology integration needs;
- Operational design; and
- Physician acceptance of telemedicine.

Twenty-one (21) representatives of selected Virginia telemedicine programs were interviewed at their telemedicine sites during the spring of 2000. The VDH contracted with the Division of Quality Health Care, Department of Internal Medicine of VCU to design the prospective study instrument which would allow comparison of all telemedicine initiatives. These instruments would be used to begin uniform data collection which would allow a cost-effective evaluation of Virginia's telemedicine programs. The study was conducted under the assumption that the Commonwealth supported, through specific appropriations and general funding, the operations of the institutions of higher education, which served as hub sites and the state agencies and affiliates that served as remote sites in the telemedicine programs. The use of telemedicine in the Commonwealth was expected to expand in the number of sites involved, in the areas of medical education that could be addressed, and in the clinical situations for which consultations were appropriate.

To address the four identified barriers and to continue the evaluation process, the investigative team made the following recommendations to the State Health Commissioner:

- Use the recommended evaluation instruments to establish a baseline assessment of the telemedicine programs and initiate a continuous quality improvement and evaluation process;
- Continue the Telemedicine Program Working Group at the Virginia Department of Health to direct the continuing telemedicine evaluation. (This group could facilitate collaboration and development of Virginia's telemedicine initiatives and evaluate future needs, especially financing, and further opportunities for telemedicine initiatives by agencies of the Commonwealth;
- Virginia Department of Health sites should ensure integration of technology through the use of an integrator; and
- Involve communities, especially local physicians, in the development and support of telemedicine programs.

The report concluded that telemedicine is expected to grow 40 percent annually over the next 10 years. Telemedicine could increase access, and distribute clinical, educational, and administrative health care resources by removing and reducing barriers imposed by time, distance, or geography. Financial and human resource investments

required for telemedicine applications could be substantial. Evaluation for cost-effectiveness and quality would be essential to ensure efficient use of health care resources.

The most recent legislative report on telehealth was published in 2003, **"Improvements Need in Current Telemedicine Initiatives and Opportunities to Enhance Access and Quality," Document No. 28,** and was authored by George Mason University and the Virginia Department of Health. VDH contracted with George Mason University's Center for Health Policy, Research and Ethics to conduct an analysis of federal and state practices related to the management, evaluation and oversight of public Telemedicine/Telehealth (TM/TH) Services in Virginia. The report built on previous reports of TM/TH services in the Commonwealth and addressed items (iii) and (iv) of the report.

- (iii) Recommendations regarding improvements needed in current telemedicine initiatives; and
- (iv) Identification of additional opportunities for use of telemedicine to improve access to quality health care and to health professional education for citizens of the Commonwealth.

The report highlighted core public health functions that serve, in part, as components of the critical infrastructure supporting of the Commonwealth's emergency preparedness response capacity. Emerging TM/TH challenges include regionalization of public health and service delivery capacity. State and local collaboration was evolving to secure critical infrastructure, including TM/TH networking capacity. Secure networks are vital to the support of public health preparedness, to public health data collection, analysis and reporting.

The report discussed legislative initiatives to assure the growth of telemedicine and telehealth services and future comprehensive evaluation efforts. The report recommended that a comprehensive strategic planning process should be the first step towards reframing policy to support a well-developed and accountable TM/TH infrastructure. Building on recommendations from previous Telemedicine reports and current state and national trends, the following recommendations were made to keep Virginia moving forward:

- Implement a comprehensive and integrated statewide telemedicine/telehealth (TM/TH) infrastructure strategic planning process;
- Establish and communicate specific authorities and particular roles for state agencies' committees, commissions, and work groups with respect to the physical infrastructure (existing telecommunication and health care resources) within the state and functional infrastructure (administrative, bureaucratic, programmatic and political);
- Establish collaborative systems to ensure interoperability among entities with authority and responsibility to process data and information;

- Coordinate processes for data information collection, management, reporting and dissemination using standardized frameworks and tools appropriate to the task for policy and program planning within each agency; and
- Create a framework for evaluation of future TM/TH activities in the Commonwealth using mechanisms and elements drawn from prior evaluation frameworks described within this study.

Needs and Solutions

Systemic Rural Problems

- Disproportionate rates of health-related problems occur in rural Virginia--due to age, race, income, education, lack of insurance, etc.--exceed those in Virginia and the United States.
- This leads to systemic health disparities among the underserved. They are the most likely to experience limitations in daily activities, to develop chronic diseases, and to experience premature deaths.
- This takes place in the context of an overburdened and ineffectively used healthcare delivery infrastructure. The underserved are also the most likely to require healthcare system navigation, and transportation to medical appointments.
- This chronic drain on resources causes an inability for medical providers, facilities, and communities to make long-term investments in their medical infrastructure. The underserved are the most likely to use hospital emergency rooms for primary care because they have no alternative. This population accounts for the largest cost to rural providers, and regional health delivery systems throughout rural Virginia.
- The recent closing of obstetrical/gynecological services in rural parts of the state has placed women with high risk pregnancies in added danger. This eroding situation raises the potential for more Emergency Room visits and higher incidences of infant mortality.
- There exists significant need for medical specialists, diagnosis, treatment and follow-up.
- The system is fragmented, inappropriately used, short-staffed, and financially burdened. Medical professionals are isolated professionally, technologically, and geographically.

Systemic Urban Problems

- Systemic health disparities are found in urban Virginia. The urban underserved populations share characteristics with their rural counterparts. They too are the most likely to experience limitations in daily activities, premature deaths, and to develop chronic diseases.
- These health disparities take place in the context of an overburdened and ineffectively used healthcare delivery infrastructure. The underserved are also the most likely to require healthcare system navigation, and transportation to medical appointments.
- This chronic drain on resources causes an inability for medical providers, facilities, and communities to make long-term investments in linking their medical facilities to a telecommunications infrastructure designed to address some of the health disparity challenges. The urban underserved, just as their rural counterparts are the most likely to use hospital emergency rooms for primary care because they have no alternative.

Solution

Provide a network that will electronically link healthcare providers, patients, educators, and consumers as one large community in which medical care/information can be exchanged freely in a secure environment. VTN will provide the following resources to address chronic health disparities and discontinuity of healthcare delivery

- Increase access to primary and specialty health care by establishing an open telehealth infrastructure system,
- Reduce health disparities by planning for the creation of a seamless health care delivery system,
- Transition VTN from a volunteer coalition of medical providers and healthcare consumers to a 501 (c) 3 Telehealth Network that can coordinate resources to execute goals.
- Provide leadership, telecommunications, management, and administrative support to connect providers by implementing Strategic and Business Plans.
- Provide equipment leasing options for medical facilities and providers that would alleviate the expense of buying equipment.

Underinsured and underserved citizens are concentrated in rural regions and urban pockets throughout Virginia. Growing numbers of older and multi-cultural Virginians are migrating to rural areas. They will demand a continuity of healthcare services such as they are accustomed to, and their health necessitates. This demand translates to a need for trained medical and mental health professionals, and ancillary support personnel who can care for them.

The demand for increasing basic health services has been described as a "mini-economic boom" for rural communities endeavoring to attract industry and tourism. Businesses who are considering relocating to rural Virginia will give serious weight to the availability of telecommunications capabilities to support their workforce and customers. Telemedicine provides cost-effective medical support for employee-based healthcare insurance plans. Telemedicine undergirds rural medical providers, clinics, and hospitals by allowing for increased medical treatments, monitoring and follow-up that previously required travel to urban medical centers.

Regional coordination of the broadband telecommunications infrastructure will provide access to current medical research findings, treatment protocols, and scheduled visitations for remote telehealth consultations. For example, there are regional emergency preparedness networks that are forming. These networks are being funded through Homeland Security dollars. Leveraging the Homeland Security funding with the Strategic Plan funding would result in a cohesive and coordinated effort linking urban and rural Virginia. Without the availability of a state-wide telemedicine infrastructure, community health and homeland security is jeopardized in times of crisis. Influenza pandemics and natural disasters require rapid and humane medical responses regardless of geographic and distance barriers.

The VTN Plan for telehealth in the Commonwealth is written in the context of a growing awareness of demographic and cultural changes in society, the need to monitor disease outbreaks and environmental threats to regional health conditions, and the overwhelming need to deliver effective healthcare services for the most reasonable return on investment.

As Americans, we have recently experienced a combination of circumstances that have strained the fragmented healthcare delivery system beyond its means to respond to regional crises. Virginia should be prepared and have the capability to respond to threats and challenges to community health.

VTN Strategic Plan provides:

- Virginia lawmakers, agency personnel, and policy analysts a guide to fund and deploy a state-wide interoperable telehealth network.
- A roadmap for governance and management for the VTN infrastructure.
- Decision guidance for managers and telecommunications vendors to advance the establishment of a state-wide telehealth network in the Commonwealth.

The VTN Plan complements the November 2005 Governor's Task Force on Information Technologies for Healthcare Report in several ways.

The VTN Plan:

- Provides the framework for building an infrastructure for patient databases;
- Fosters regional cooperative ventures and other grass-roots management models for healthcare data exchanges;
- Spreads start-up costs across a larger purchasing pool thus lowering barriers to entry;
- Provides economies of scale pricing for development and maintenance of the telehealth broadband backbone;
- Provides the necessary components to issue request for proposals (RFPs) from telecommunications vendors; and
- Offers a management model for marketing and maintenance of the Network to insure its viability and self-sustainability.
- Provides lease options for customer premise equipment (CPE)

The VTN Plan ensures the Virginia telehealth infrastructure will be ubiquitous.

Features of the Virginia Telehealth Network

Traditionally, medical facilities (Hospitals, Clinics, Physician offices) look to acquiring medical devices with digital/electronic outputs and clinical software applications as one purchase and "End-To-End" Telecommunication Connectivity to outside facilities (hospitals, clinics, physician offices, patient homes, insurers offices) as another. Having the devices and software within the medical facilities with no telecommunication network infrastructure outside the facilities creates a less than optimum return on investment on devices and less than optimum outcome for patients, medical staffs, and physicians.

Increased patient care, greater patient safety and operational efficiencies are synonymous with modernization of medical devices to produce digital/electronic outputs, clinical software applications and a telecommunications infrastructure as a single balanced system. Generating digital/electronic medical information in the form of text and images is crucial to create mobile Electronic Medical Records (EMRs).

VTN is the only organization that ensures that all communities not only have the ability to access telehealth services via a broad range of access methods, from high bandwidth to connections that use dial-up modems, but also the ability to receive acquisition support for medical devices that produce digital/electronic data that can be transported over the network.

VTN provides the only "One Source" for "End-To-End" dedicated Telecommunications Network for healthcare, and acquisition support to medical facilities for procurement of such devices as Digital Home Monitoring and Picture Archiving Communications Systems and applications such as Emergency Departments Information Systems and Medication Verification Systems. Acquisition support includes helping clients identify the best devices and software applications for the money they have available and for purchase, lease or lease to own options. VTN staff can provide technical assistance to ensure the telecommunication infrastructure is adequate to handle the data generated and in-line with overall operational expectations of individual facilities.

VTN Guiding Principals

Allow users open access to the infrastructure tailored to telehealth applications

- insure consumer choice both for providers and patients.
- be user friendly and marketed for maximum utilization.
- include human factors design principals for rapid adoption of telehealth applications.
- be financially viable and self-sustaining through a variety of revenue streams, including teleconnectivity fees, providing technical assistance, coordination, and engineering design and installation.

Task Force Objectives

1. Conduct a comprehensive statewide investigation of telemedicine utilization needs for each region of Virginia. Survey findings should provide data for assessing community and provider readiness for telemedicine applications. The information gathered will guide management decisions for the phased regional deployment of the Network.
2. Develop the Network as a flexible, scalable, manageable, secure, and cost effective infrastructure capable of linking all communities within Virginia
3. Provide network management services for
    a. Interfacing and data exchange,
    b. Calendaring/scheduling and conferencing functions,
    c. HTTP/SMTP services within and outside of Virginia
    d. Continuing professional education, public education, and emergency broadcasting
    e. Technical assistance to end-users
4. Obtain legislative funding for regional roll-out of the Strategic Plan.
5. Structure a nonprofit organization that includes a shared-governance framework to ensure consumer choice, based on end-user led policies and management operations.
6. Provide relevant and timely reports with annual program evaluations.

Telecommunications capabilities that are integrated within healthcare providers' services will significantly determine the quality of care Virginians receive and will contribute to the overall health of rural and urban communities. The ability to connect to each other is imperative and 'do-able".

The VTN Strategic Plan reduces some of the obstacles that prevent hospitals and medical facilities from adopting modern digital medical systems applications by allowing them the choice to group lease versus single purchase telehealth equipment that can ride on the VTN broadband backbone. VTN technical staff can work with medical facilities to identify the "best of breed" clinical digital equipment to lease through the Network.

- **Video consultation calendar functionality**. Major impediments (identified in the Site Survey) to the use of video teleconferencing for patient consultation were (a) logistical difficulty and (b) the associated expenses of consultation scheduling. In order to address this problem, VTN will deploy commercially available software to facilitate video teleconferencing scheduling and inter-connection. The calendar function software provides a "work-flow engine" which allows users to schedule VTC consultation via a web interface and then issues e-mail reminders to participants

- **Rural healthcare facilities and regional partnership grant development assistance**. Rural healthcare facilities are resource constrained in terms of budgetary and staff resources. Both of these factors present significant impediments to rural health facilities participation in the VTN. However, significant grant funds are available to eligible organizations from state and federal funding organizations such as the Federal Communications Commission, and the federal United States Department of Agriculture's Rural Utilities Service. Therefore, (depending upon resource availability) the VTN organization can provide rural health facilities with technical grant support for their first year of VTN access.

- **Video equipment leasing, web meeting services, home health monitoring services, etc.** Two barriers to purchasing, modernizing, or upgrading telehealth technologies (digital medical devices and systems such as Picture Archiving Communications Systems and Computerized Physician Order Entry Systems), are (a) the large outlay of up-front capital expenditures that are required for the new equipment and (b) the connectivity charges to link with other facilities.

Vision

The vision for the statewide digital virginia telehealth network is to provide a state of the art telecommunications infrastructure on which to provide services to achieve the delivery of world-class telehealth-care to rural virginians.

Overarching goals for rural healthcare in Virginia

1. To increase the health of both rural and urban communities by providing access to medical and telecommunications technologies
2. To increase the longevity and quality of life for Virginians by providing access to patient and public health information
3. To increase the ability of medical professionals and patients to respond to natural and man-made disasters and threats by electronically linking rural communities throughout Virginia

The Virginia Telehealth Network will employ telehealth technologies to achieve the VTN Vision by:

- increasing access to primary and specialty medical healthcare services
- decreasing healthcare related costs by providing
    - cost effective fee-for-services,
    - central management services,
    - security and firewall services, and by implementing the
    - high speed Virginia Telehealth Digital Network
- establishing a financially self sufficient network
- providing the ability to lease digital medical systems such as home health monitoring devices to hospitals, clinics and medical practices. Future applications for the digital Network include Picture Archiving Communications Systems (PACS), Computer Physician Order Entry Systems, Patient Medication Verification Documentation Systems
- utilizing the Network to link the digital information to other hospitals, medical facilities and physician practices.

As envisioned by the Plan, these services will be a driving force in enrolling customers. The Virginia Telehealth Network would indeed be a fully-functioning Telehealth Solutions Provider, enabled by innovative technology, and in line with Virginia's goal to provide the best quality and most appropriate healthcare to the citizens of the Commonwealth.

Local public health agencies, hospitals and health systems, clinics, health professionals, faith communities, safety-net organizations, social services agencies and other nonprofit organizations working to improve the health of the community will have access to a range of services provided through the VTN.

The VTN will be accessible within every region, medical market, and community in the commonwealth starting in medically underserved rural areas (MUAs); health professional shortage areas (HPSAs); communities with high disease and chronic health condition disparities; and communities that demonstrate a "readiness for deployment".

A. The VTN will utilize existing telecommunication infrastructure established by telephone, cable, cellular, microwave, and satellite communications companies, as appropriate. The utilization of existing infrastructure, and the deployment of telecommunications where there is no infrastructure, will permit mentally, physically, and cognitively challenged patients, their families and providers, the chance to receive specialty care, primary telehealth-care, patient family education, and continuing professional medical education without leaving their homes, offices and communities.

The VTN will afford physicians and mental health professionals access to their patient's information. It will provide the capability to disseminate information and

provide consultations by employing video and/or image and/or telephone conferencing. Mental health, medical providers, subscribers to VTN services, or any member of the VTN can communicate literally anywhere and be virtually connected by using telecommunication technologies. VTN end-users will have access to patients, other physicians, medical facilities, and any other subscriber on the VTN.

This table represents 7472 total specialty teleconsults performed by UVA, as of May 2005.

Specialty	Count Of Medical Specialty Consultations
Cardiology	105
Childhood Ob	18
Dermatology	1141
Endocrinology	193
ENT	40
ER	1
Gastroenterology	99
Genetic Counseling	57
Genetics	2
Geriatric Counseling	1
Gynecology	28
Hematology	35
Hepatology	1518
ID	1822
Nephrology	113
Neurology	261
Neurosurgery	10
Nutrition	1
Oncology	2
Ophthalmology	2
Orthopedics	75
Pain Manage	8
Pediatrics	10
Peds Echo	1345
Plastic Surgery	6
Psychiatry	299
Pulmonology	15
Retinopathy	208
Rheumatology	7
Surgery	10
Thoracic Cardiology	1

Toxicology	4
Transplant	4
Urology	8
Wound Care	23
TOTAL	**7472**

B. The VTN can be used for data, video, image and telephone consultations. It can also be used to provide education to public mental health and medical agencies, hospitals and health systems, clinics, health professionals, faith communities, and other organizations.

From a home telehealth perspective, the VTN can be used for programming that educates and/or monitors medical conditions. Medical conditions, which have shown to be improved, and cost-effectively monitored by home health personnel using telehealth applications include:

Asthma	Diabetes	End-State Renal Disease
Severe Anxiety	Cancer	Spinal Cord Injury
AIDS	High Risk Pregnancy	Pregnancy Induced Hypertension
Hospice	Wound Management	Medication Compliance
Depression	Post Operative Conditions	

VTN Capabilities

The VTN goals can be achieved through the deployment of a telecommunications services infrastructure capable of delivering:

- Robustness
  Allowing for simultaneous voice, video, imaging and data sessions;
- Cost Effectiveness
  Utilizing modern telecommunication technology and existing wire, fiber optic and wireless telecommunications circuits;
- Ease of Use
  Using standard off the self equipment including PCs, hand-held personal assistant (PDA) and other equipment;
- Manageability
  Using a centralized management approach and Help Desk to oversee the entire operation on a daily basis and also support lease equipment;
- Reliability
  Using quality name brand equipment with high operational availability rates, and existing telecommunication lines and systems;
- Dependability
  Using multiple paths both on the backbone and access to remote communities where possible;
- Scalability
  Allowing for flexibility of design to handle small, large, and growing areas;
- Maintainability
  Using standards based equipment with maximum warranty periods, technology refreshment as life cycle and technology advancement, remote monitoring and diagnostics software from the centralized management Help Desk and outsourcing on-site maintenance when and if needed;
- Capability
  Linking other network nodes to the VTN within and outside the state;
- Accessibility
  Facilitate telehealth over a private network through direct connection, virtual private network, the public Internet or, dial-up connections;
- Sustainability
  Raise income through a variety of revenue generating services, leasing of equipment and broadband facilities leasing;
- Security
  Using 128 Bit security encryption, the highest available security on commercial market

Recommendations

VTN Infrastructure and Services

In order to facilitate universal access to telehealth services in rural Virginia and to connect to providers in urban Virginia, the Strategic Plan proposes the development of a dedicated telehealth infrastructure, network, and organization – The Virginia Telehealth Network (VTN).

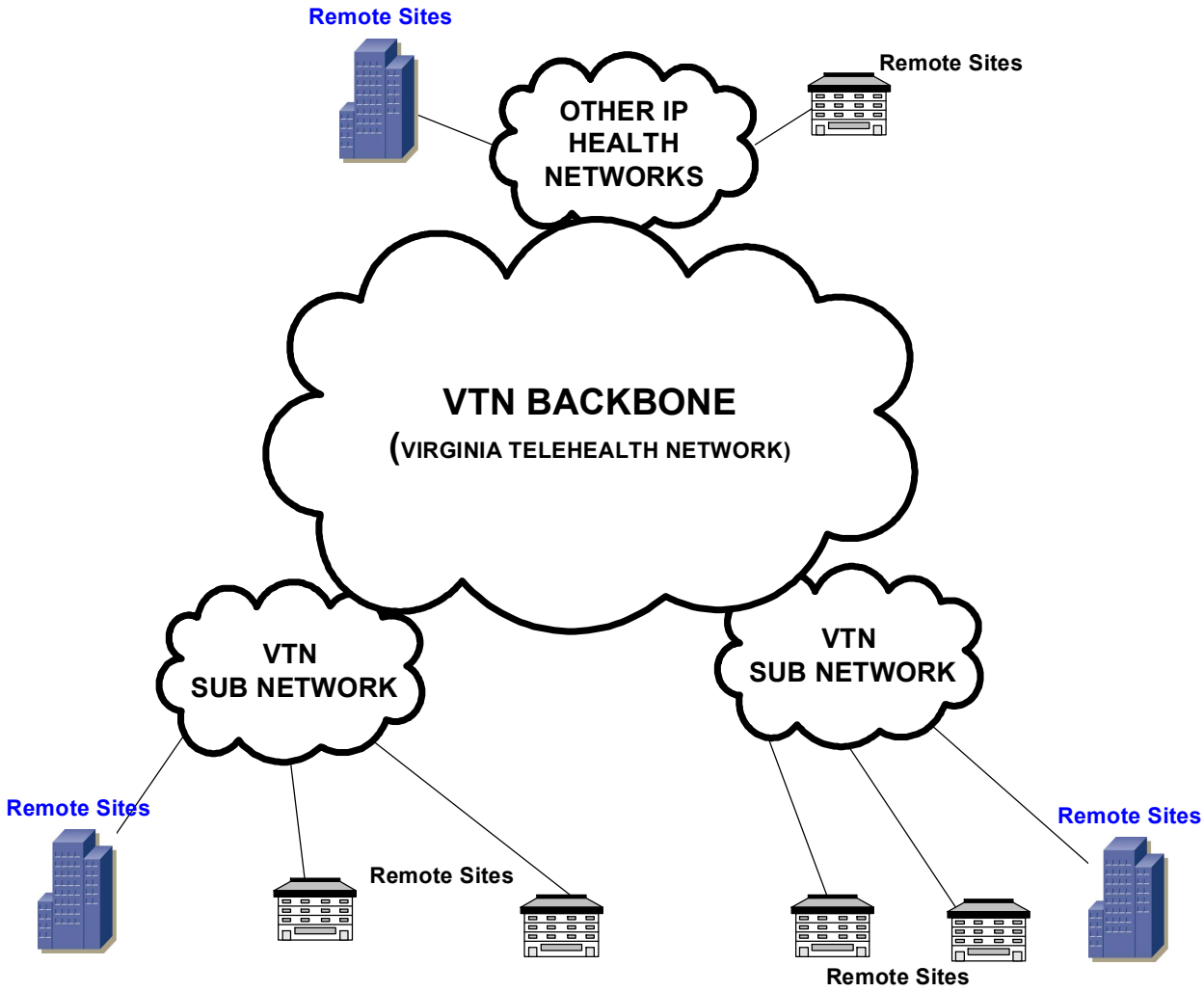
VTN will be available to all public and private healthcare related organizations, as well as individuals, in the Commonwealth. VTN will ensure that all communities within Virginia will have the ability to access telehealth services via a broad range of access methods, from high bandwidth to connections that use dial-up modems.

VTN will provide a flexible, scalable, manageable, secure, and cost effective network infrastructure capable of linking all communities within Virginia. The Network will generate service revenues to ensure its market viability. In addition, VTN will allow network users to interface and exchange information with organizations in other states and outside of the United States:

The conceptual diagram on the next page illustrates how the VTN backbone *to be leased from telecommunications carriers* will provide connectivity throughout the Commonwealth, and beyond, for VTN subscribers. VTN will be composed of an OC3 back-bone network based on industry standard multi-protocol label switching (MPLS) technology. The VTN backbone will be facilities based. This means that VTN bandwidth will be leased from commercial network carriers.

Note: VTN is not a telecommunications company and VTN will not deploy new fiber. VTN's only assets will be routers, network management equipment and software, and some shared medical diagnostic and analysis equipment.

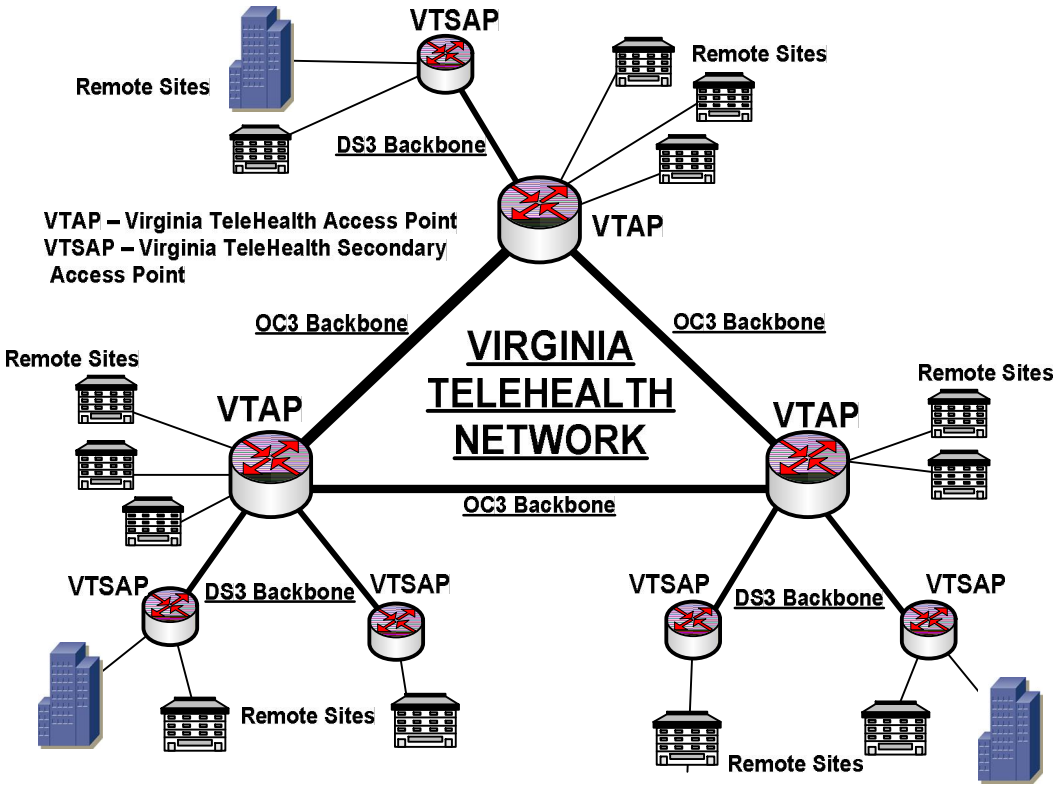
This diagram illustrates the conceptual VTN backbone, its subnetwork connections and how it will interface with other IP health networks and remote sites.



VTN will deploy network access points throughout Virginia. These network access points are physical locations where VTN equipment is housed, which allow network users to access the VTN and other networks. An access point may actually reside in a rented space owned by a telecommunications carrier. VTN will have two sizes of access point. Virginia Telehealth Access Points (VTAPs) will be located throughout the Commonwealth in areas where higher levels of bandwidth are required. VTAPs will provide access connectivity up to OC3. This bandwidth will accommodate the larger network participant's bandwidth requirements. Virginia Telehealth Secondary Access Point (VTSAPs) will provide access up-to DS3 speed, and will be located where the bandwidth requirements are less than those served by a VTAP. VTSAPs will be much less expensive to deploy and maintain than

VTAPs. Therefore, VTSAPS can be deployed in rural areas and will be accessible by 56K dial-up lines. VTAPs and VTSAPs will be deployed over a multi-year period in accordance with the phased roll-out plan described in the Executive Summary.

This diagram illustrates how VTN will support a broad range of local access methods which will ensure that Commonwealth communities can access VTN regardless of their existing telecommunications infrastructure.



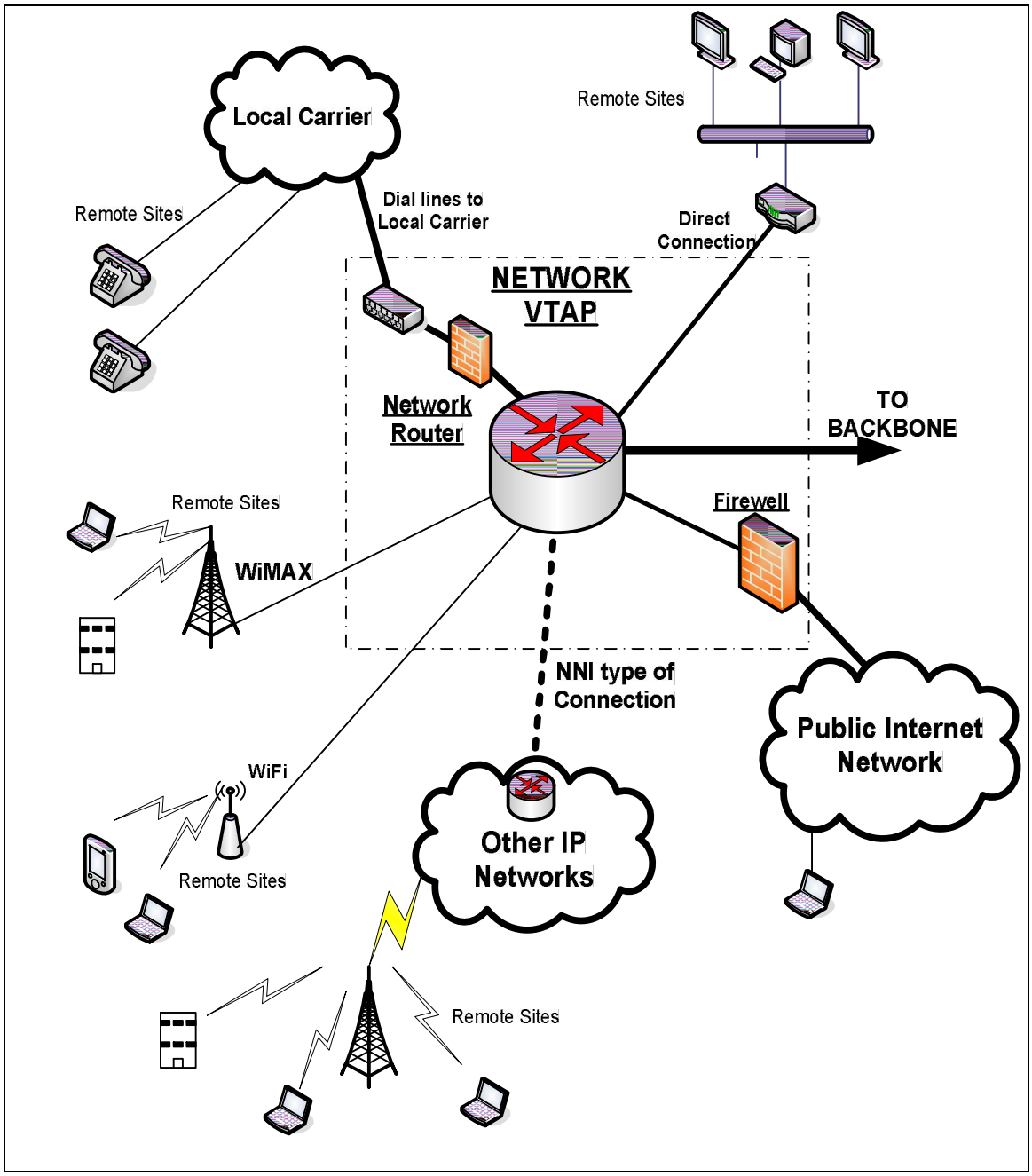
In areas of Virginia where local access is limited, VTN will work with alternate access providers to ensure access to the VTN telehealth infrastructure. VTN's potential customer base will provide a revenue justification for access providers to establish service in rural areas not presently served.

VTN will be accessible by using wire line and wireless access technologies at the following speeds:

Dial/Analog (56kbps)
Internet
Direct Subscriber Line (DSL)
Broadband
Wireless Access
Cellular
NNI (Network to Network Interface)

High Speed
56k DS0
NxDS0 with a DS1 Local Access
DS1
Sub-rate DS3 with a DS-3 Local Access
DS3
OC3 SONET based services

This diagram illustrates access methods supported by VTN:



Further, VTN will support network access via multiple transmission services that include:

- Frame Relay
- ATM
- Private Line
- Public Internet through level 3 VPNs
- ISDN
- Analog Dial Access

VTN Users Services

As VTN is deployed, the network infrastructure will support an increasing portfolio of user services. The end-user will be supported by VTN, for example, by having access to:

- Network Access (connectivity)
- Video-Bridging
- IP Multi-casting
- Equipment Leases
- Store and Forward (Year 2)

The core VTN services will support video-conferencing and tele-education. However, in order to attract users to the VTN, a portfolio of value added services will be available which will specifically address the needs of healthcare providers in Virginia. As VTN is deployed throughout Virginia, the value added service portfolio, described above, will be developed in accordance with site specific needs assessments provided by end-users, in conjunction with VTN marketing and technical staff.

Architecture

Introduction

Network design, whether within a company or across a state, requires that information from multiple sources be collected, analyzed, and catalogued. Source data for the design of the VTN includes information gathered through the 2003 site survey and the VTN Telemedicine Inventory File. The following considerations were addressed in this source data.

Classification of Locations
Architecture
    Backbone
    VSAP & VRSAP
Local Access Requirements & Service requirements

Architecture

The VTN infrastructure plan ensures that all communities within the state have the ability to connect to the broadband backbone regardless of facility type or availability of bandwidth. During the initial phases of the project many locations will be using a 56Kps dial up connection over a dedicated POTS line. The Network must be able to accommodate the use of present day telecommunication connectivity technologies while planning for the future implementation of new technologies as they emerge and become available.

VTN will provide all users, especially those in underserved healthcare areas (HPSAs and MUAs), and underdeveloped rural telecom areas the ability to increase bandwidth as telecommunications and cable industries install broadband services and systems. Software developers are creating more complex applications that require ever-increasing bandwidth availability to be used effectively. Medical communities are using high bandwidth applications in clinical settings, i.e., Radiology, Pharmacy, Nurse/Patient Medication Verification, just to name a few. Development of an Electronic Health Record (EHR), with the potential to increase services to patients, increase patient safety, provide for information security and patient privacy, contains the promise of reducing medical operating costs.

The VTN's greatest value will be its ability to serve all users from the very low to high bandwidth user. It will be designed to have the capability to support all of the applications that its users may require. The VTN Backbone will be reliable, dependable, and secure while providing a high speed highway on which data, video and voice can travel. This network will be built with the understanding that that data, video, and voice transmission have different technical requirements for quality service delivery. The priority of services roll-out will be Voice first, Video second, and Data third.

Trends in LAN/WAN Integration

Today, 90% of computing power resides on desktops, and this power is growing exponentially. Distributed applications are increasingly bandwidth-hungry, and the Internet is driving many Local Area Network (LAN) architectures to the limit. Voice communications have increased significantly, with more reliance on centralized voice-mail systems for verbal communications. The network is the critical tool for information flow. Networks are being pressured to cost less, yet support emerging applications and more users, while at the same time deliver higher quality with increased performance.

Local- and wide-area communications have remained logically separate. In the LAN, bandwidth is free, and connectivity is limited only by hardware and implementation costs. In the Wide Area Network (WAN), bandwidth has been the overriding cost, and such delay-sensitive traffic as voice has remained separate from data. New applications and the economics of supporting them, however, are forcing these conventions to change.

As companies begin to consider implementing new intranet-based, bandwidth-intensive multimedia applications over IP —video training, videoconferencing, and voice, for example—the impact of these applications on the existing networking infrastructure is of concern.

Designing WANs

WAN communication occurs between geographically separated areas. In enterprise networks, WANs connect campuses or remote sites. When a local end station wants to communicate with a remote end station (an end station located at a different site), information must be sent over one or more WAN links. Routers within enterprise networks represent the LAN/WAN junction points of a network. These routers determine the appropriate path through the network for the required data streams.

WAN infrastructure or backbone is provided through the following primary technologies:

- Circuit switched (TDM - Private Lines ex T1s)
- Packet switched (Frame Relay) & Cell switching (ATM)
- IP Based (MPLS)

Trends in WAN Design

Traditionally, WAN communication has been characterized by relatively low throughput, high delay, and high error rates.

Traditional shared-media networks are overtaxed because of the following new network requirements:

- Necessity to connect to remote sites
- Growing need for users to have remote access to their networks
- Explosive growth of corporate intranets
- Increased use of enterprise servers
- More complex information exchange (more bandwidth requirements)

Networks are designed to support WAN connections, handle mission-critical information, and are optimized for price/performance bandwidth. The routers connecting the sites, for example, generally apply traffic optimization, multiple paths for redundancy, dial backup for disaster recovery, and QoS (Quality of Service) for critical applications.

Technology Options

Frame Relay

Frame relay technology is based on the concept of virtual circuits (VCs). VCs are two-way, software-defined data paths between two ports that act as private line replacements in the network. PVCs are initially defined as a connection between two sites

or endpoints. Frame relay is a synchronous protocol where data is carried across a communications line in frames that are similar in structure. This service is becoming 'decommissioned' by most of the large carriers and is being replaced with MLPS systems.

ATM

Asynchronous Transfer Mode technology (ATM) is a layer 2 networking technology based on the concept of using VCs. Unlike frame relay's variable-length packets, the ATM protocol uses fixed-length packets (cells) to transport user data across the network. It is the use of these fixed-length cells that allows ATM to support a range of applications and traffic types. Cells are statistically multiplexed and network capacity is dynamically allocated based on the real-time needs of the supported applications.

Private IP (MPLS)

Private IP service is based on multi-protocol label switching (MPLS) technology. MPLS enables networks to take advantage of the best of IP, ATM, and frame relay by allowing the integration of layer 2 switching (ATM and frame relay, for example) and layer 3 routing (IP). The MPLS signaling protocols support and create labels required to move the traffic across the network. The labels identify the end-address destinations of the network traffic, as well as quality of service (QoS) information for the prioritization of traffic across the network. QoS capability allows for the transmission of both real-time applications such as voice and video, along with data traffic, across the same network infrastructure.

A MPLS backbone network offers full IP routing capabilities from customers' site locations to other customers' site locations through the network. A MPLS backbone network utilizes frame relay and ATM PVCs for access into the core network. This allows for a simple migration from an existing frame relay or ATM network. These PVCs pair with the edge MPLS switch and not the destination router. Frame relay and ATM are simply used as transport mechanisms to the MPLS edge router. Additional benefits include inherent any-to-any connectivity, class of service offerings, and seamless inter-working.

Network Based IP VPNs

While Frame Relay and ATM networks (layer 2) communication is handled from location to location via PVC, Internet protocol (IP) requires each device connected to the Internet to be identified by a unique number, the IP address. Since there is no permanent circuit required for locations and devices to communicate with one another, a "connectionless" network is possible.

The Internet is the largest public network, as it is an accumulation of many service providers' facilities connected in a hierarchical fashion. Anyone can freely participate in this network as long as they are registered with a unique IP address. Some of the concerns with using this infrastructure as a backbone are the lack of security and the ability to provide voice and video services.

Network-Based Gateways

Inter-networking allows users to share information privately and securely across a variety of physical network topologies. Gateways are responsible for logical connection termination, authentication, security, and protocol conversion.

Network-Based Gateways will perform authentication for customer to access the backbone network. A dynamic virtual interface is created for a tunnel endpoint by the configured Virtual Private Routed Network (VPRN) for the duration of the remote access session. At the end of the session the virtual interface is removed, the VPRN route table is updated. The VPRN functions as a conventional IP router, with "awareness" only of the data arriving over the active virtual interfaces, so that there is no constraint on the customer's IP addressing plan. It builds a route table with static and/or dynamically generated routes, and forwards datagrams to the virtual interface indicated by the route table. In this way, traffic can be routed between many remote clients and destinations on the network.

Protocols Supported

Protocols are the special set of rules used by end-points to communicate in a telecommunication connection. Protocols are often described in an industry or international standard. Protocols exist at several levels in a telecommunication connection, i.e., within hardware or between each of several functional layers and its corresponding layer at the other end of a communication. To communicate, both end-points must recognize and observe a protocol.

The customer's choice of protocol depends on a number of considerations including customer's network and site topology, existing routing protocol, CE capabilities and customer routing requirements. These are general guidelines for VTN deployment when selecting a routing protocol:

- Static routing for customers that have no requirements for dynamic routing.
- If dynamic routing is required then BGP
- RIPv2
- OSPF

VTN will support multiple routing protocols between VTN's Provider Edge (PE) and Customer Edge (CE) routers including static routing, BGP, RIPv2, and OSPF.

Border Gateway Protocol (BGP)

BGP is a protocol that is used for exchanging routing information between gateway hosts (each with its own router) in a network of autonomous systems. BGP is often the protocol used between gateway hosts on the Internet. The routing table contains a list of known routers, the addresses they can reach, and a cost metric associated with the path to each router to ensure that the best available route is chosen.

Hosts using BGP protocol communicate using the Transmission Control Protocol (TCP) and send updated router table information only when one host has detected a change. Only the affected part of the routing table is sent. BGP-4, the latest version, lets administrators configure cost metrics based on policy statements. BGP communicates with autonomous (local) networks using Internal BGP (IBGP) since it doesn't work well with IGP. The routers inside the autonomous network thus maintain two routing tables: one for the interior gateway protocol and one for IBGP.

Benefits of BGP

- Widely used in the industry for communications between autonomous networks
- Extensive routing policies for implementation of complex or simple networks
- Less "chatty" protocol

Shortfalls of BGP

- Lacks metric diversity of an IGP
- Some policies are not possible due to inherent path selection processes
- Not supported on some low end routers

Routing Information Protocol (RIP)

RIP is a widely-used protocol for managing router information within a self-contained network such as a corporate local area network (LAN) or an interconnected group of LANs.

Using RIP, a gateway host (with a router) sends its entire routing table (which lists all the other hosts it knows about) to its closest neighbor host every 30 seconds. The neighbor host, in turn, will pass the information on to its next neighbor, and so on until all hosts within the network have the same knowledge of routing paths – a state known as network convergence. RIP uses a hop count to determine network distance. Each host with a router in the network uses the routing table information to determine the next host to route a packet to for a specified destination.

RIP is considered an effective solution for small homogeneous networks. For larger, more complicated networks, RIP's transmission of the entire routing table every 30 seconds may put a heavy amount of extra traffic on the network.

Benefits of RIPv2

- Easy to configure and troubleshoot
- Non-proprietary
- Supported by most vendors

Shortfalls of RIPv2

Lack of decision metrics

- Only applicable to small enterprises
- Slow to converge
- Non-scalable due to hop count limitations
- Transmits entire routing table every 30 seconds
- No load balancing or loop detection abilities

Open Shortest Path First (OSPF)

OSPF is a router protocol used within larger autonomous system networks in preference to RIP, which is more commonly installed in many of today's corporate networks. Like RIP, OSPF is designated by the Internet Engineering Task Force (IETF) as one of several Interior Gateway Protocols (IGPs).

Using OSPF, a host that obtains a change to a routing table, or detects a change in the network, immediately multicasts the information to all other hosts on the network so that all will have the same routing table information. Unlike RIP, which sends the entire routing table, the host using OSPF sends only the part that has changed. With RIP the routing table is sent to a neighbor host every 30 seconds. OSPF multicasts the updated information only when a change has taken place.

Rather than simply counting the number of hops, OSPF bases its path descriptions on "link states" that take into account additional network information. OSPF also lets the user assign cost metrics to a given host router so that some paths are given preference. OSPF supports a variable network subnet mask so that a network can be subdivided. RIP is supported within OSPF for router-to-end station communication. Since many networks using RIP are already in use, router manufacturers tend to include RIP support within a router designed primarily for OSPF.

Benefits of OSPF

- Wide range of metrics used in making path selection, e.g., bandwidth, delay
- Widely utilized, utilized across majority of vendor routing platforms
- Routing hierarchy increases stability

Shortfalls of OSPF

- IGP requires more resources from the Premise or Network Edge (PE) router
- Administrative burden increases with number of nodes on the network
- Requires more resources from Customer Edge (CE) router

Enhanced Interior Gateway Routing Protocol (EIGRP)

EIGRP is a proprietary protocol only supported on Cisco Routers. Testing on the ESR's in 2004 determined that the Cisco IOS used in the Private IP Provider Edge Devices (PE) will not support EIGRP. An IOS upgrade to support EIGRP is not scheduled to occur until late 4Q/2005. Following the upgrade, testing will be conducted to determine if an upgraded Cisco IOS will support EIGRP. Once testing is completed and EIGRP has been certified the Layer 3 provisioning tools must be upgraded.

Backbone Design

Backbone Requirements

The goal of the backbone network is to pass information securely and efficiently between end-users. This can be attained through a variety of technologies, each with a unique list of desirable characteristics. Choices range from dedicated circuits offering privacy and security with limited flexibility, to layer 2 shared data networks offering simplified management and increased flexibility, through layer 3 networks offering extended coverage options which often lead to greater security concerns. End-users will likely have a list of communication requirements that could include:

- QoS (Quality of service) separation for applications
- Ability for any site to communicate with any other site on the network
- Access to the backbone through public Internet resources
- Varying access speed requirements and access methods
- Security requirements including encryption
- Geographic coverage
- Level of management required
- Able to communicate with other networks
- Ability to build Extranets (talk to other networks)

In some cases the end-user may have different requirements at each site, and each site could be better served by a different networking technology. The end-user can choose to inter-work technologies to attain a broader spectrum of characteristics. This is typically a costly approach since it requires investment in multiple infrastructures and requires a high degree of technical expertise to manage.

Backbone Forecast

The following forecast was generated by using the table below and the following data:

- Data from 270 known sites plus a list of possible sites that could be added to the Network,
- The maximum number of sites that could be installed in one year, and
- Time frames for broadband access availability in rural areas of Virginia.

			Year one		Year two		Year three		Year four	
Class	SPEED	Mbps	# of Sites	Total Band-width	# of Sites	Total Band-width	# of Sites	Total Band-width	# of Sites	Total Band-width
MOS-1	OC-3	155	0	0	1	77.5	3	232.5	5	387.5
MOS-2	DS-3	45	3	67.5	6	135	26	585	75	1687.5
MOS-3	N* T1	3	5	7.5	20	30	50	75	100	150
ROS-1	T1	1.544	65	50.18	125	96.5	200	154.4	300	231.6
ROS-2	384kbps	0.384	25	4.8	50	9.6	50	9.6	75	14.4
ROS-3	56KBPS	0.056	100	2.8	125	7	200	5.6	200	5.6
		Total	**198**	**132.78**	**327**	**355.6**	**529**	**1062.1**	**755**	**58512.5**
				OC3		**2xOC3**		**OC12**		**OC48**

The table above shows that the Backbone Bandwidth requirements are as follows:

1) **Year one ……OC - 3**
2) **Year two…… 2 x OC - 3**
3) **Year three…...OC - 12**
4) **Year Four……OC - 48**

The total number of projected sites on the network would be:

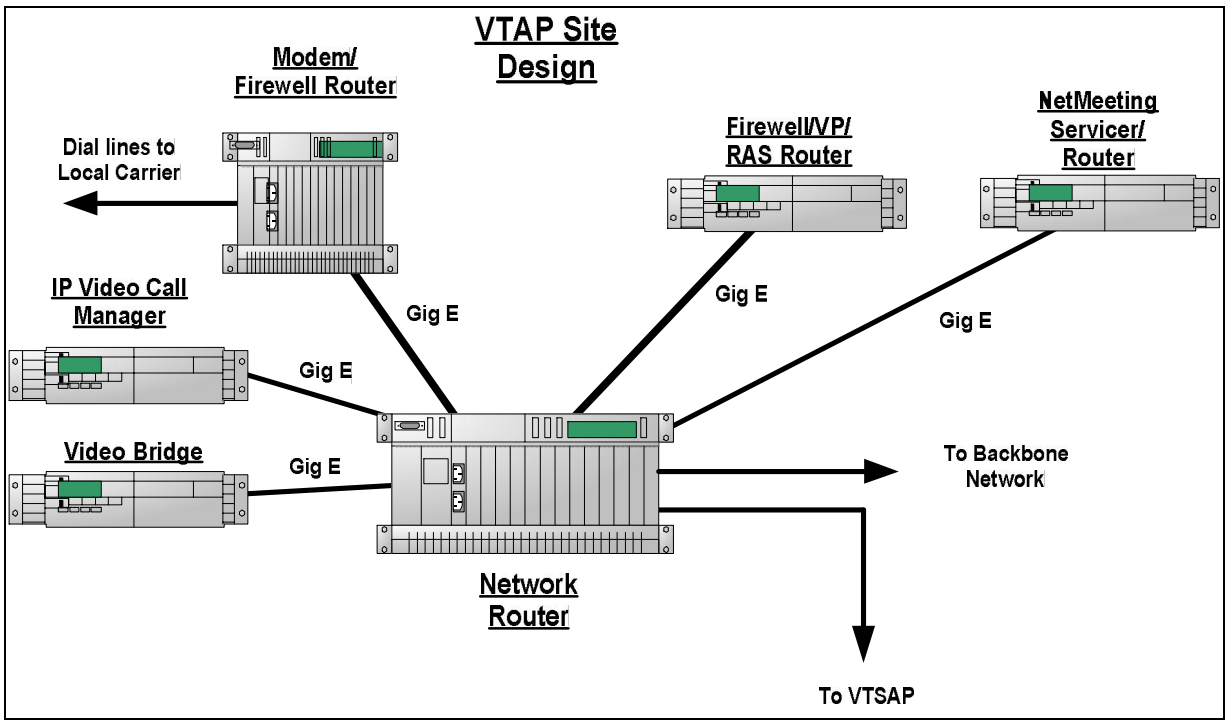
1) Year one – 198 sites at a roll-out rate of 16 sites per month. Note that most sites use dial-up lines.
2) Year two – 129 new sites for a total of 327 sites – roll-out rate: 11 sites per month. This requires more T1's because of dial-up sites migrating to digital facilities as they become available.
3) Year three – 202 new sites for a total of 529 sites – with greater migration to higher bandwidth speed due to more intense applications
4) Year Four – 226 new sites for a total of 755 sites – The increase of new sites should plateau to around 50 to 75 new sites; however, bandwidth requirements should increase substantially thereafter as locations will require greater bandwidth for new services and telemedicine applications.

VTAP and VTSAP Design

The overall design of both the VTAP (Virginia TeleHealth Access Point) and VTSAP (Virginia TeleHealth Secondary Access Point) is depicted in the following conceptual diagrams.

VTAP

The VTAP is the major network hub location. This drawing depicts its overall design.



Equipment requirements for the VTAP Site Design:

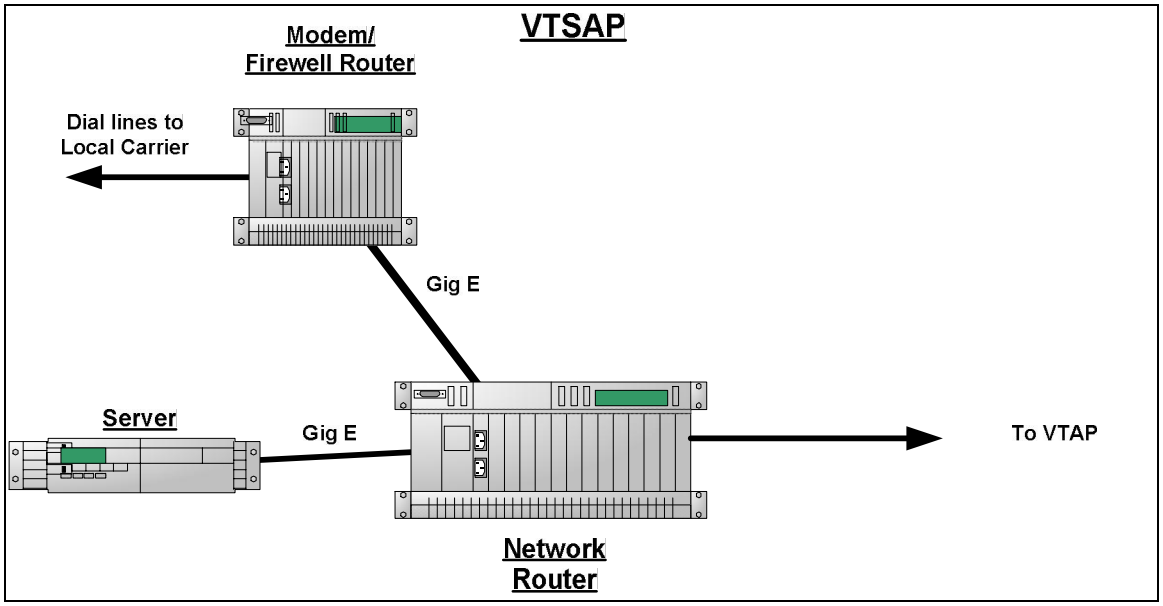
Network Router

- Card Requirements
  - Backbone connection speed requirements are DS-3, OC3 and OC12
  - Customer Side T1, DS-3 & OC-3
  - Max amount if internal memory
- Software Requirements
  - Provide IPv6 capability
  - Provide MPLS Capability
  - Internal Network Management Probe
  - Network Based QoS

- Video Bridge (Phase one in only one location)
    - 50 port access
    - Handle new H.624 Video Standard
    - DiffServ QoS capability
    - Encryption Capability
- Modem/Firewall Router
    - Should max out a 100 ports
    - First set up for 20 Port

VTSAP

The VTSAPs are the remote Network access points. This drawing depicts its overall design.



Equipment requirements for the VTSAP Site Design:

Network Router

- Card Requirements
    - Backbone connection speed requirements are DS-3
    - Customer Side T1 & DS-3
    - Max amount if internal memory
- Software Requirements
    - Provide IPv6 capability
    - Provide MPLS Capability
    - Internal Network Management Probe
    - Network Based QoS

Modem/Firewall Router

- Should max out a 100 ports
- First set up for 20 Port

Local Access Requirements

Findings from the initial VTN survey indicate most rural locations in Virginia require more bandwidth than is available. One VTN benchmark will be the provision of broadband facilities to rural Virginia.

Local Access Types

This section will review several types of local access and their interface in the VTN.

1) Dial/Analog (56kbps)
2) Internet
    a. Dial
    b. DSL
3) Broadband
    a. DSL
    b. Wireless Access
    c. Cellular
    d. NNI (Network to Network Interface)
4) High Speed
    a. 56k DS0
    b. NxDS0 with a DS1 Local Access
    c. DS1
    d. Sub-rate DS3 with a DS-3 Local Access
    e. DS3
    f. OC3 SONET based services

Dial (Analog) Local Access

Dial access can be accomplished in two ways: (1) through the Internet (VPN) which will be discussed in the next section, and (2) via direct dial to a modem bank located at network POP locations. A local number will be provided. Top speed will be 56kbps.

This access method will become popular with locations that do not have access to broadband facilities. The Strategic Plan estimates that the largest number of sites on the VTN will have dial-up or Internet access. This type of access will be much faster than access through the public Internet.

Public Internet Access

This type of access will be available for those locations that already have it and do not what to have dedicated access today. Access to VTN can be accomplished through VPN technology.

Broadband Access

Broadband access encompasses the following different services.

- DSL
- Wireless
- Cellular (CDMA)
- Each of these services is very different from the other but all can provide broadband access.

DSL Access

It is unknown if this service will be available until the network can obtain access to the local carrier's central office (CO) locations and place DSL equipment there. This will require further investigation. DSL access with the local cable and power provider will also need further investigation.

Wireless Access

There are three main types of wireless access:

- WiFi
- WiMAX
- Cellular

WiFi

Commonly called Hot Spots, WiFi has a very limited range, but can be easily installed and can be very cost-effective. This option would only be used where there are many locations in close proximity to each other. Rural locations are not as likely to use WiFi.

WiFi equipment follows IEEE 802.11 standards which describe equipment performance. The standard that can be supplied is QoS , high-quality video, voice and Advanced Encryption Standard (AES).

802.11e will deliver stream or two way high-quality video by adding quality of service (QoS) mechanisms to a WiFi network. 802.11e will supply eight priority levels. 802.11e will support Advanced Encryption Standard (ASE) for security.

WiMAX

WiMAX standard delivers carrier-class performance in terms of robustness and QoS and has been designed from the ground up to deliver a suite of services over a scalable, long range, high capacity "Last Mile" wireless communication. This application include residential broadband access – DSL level service for SOHO and small clinics, T1 level service for larger sites, wireless backhaul for hotspots and cellular tower backhaul service. Data, Voice and Video are all supported by this technology.

WiMAX follows the IEEE standard of 802.16a PHY Layer. The first version of the 802.16 standard released addressed Line-of-Sight (LOS) environments at high frequency bands operating in the 10-66 GHz range, whereas the recently adopted amendment, the 802.16a standard, is designed for systems operating in bands between 2 GHz and 11 GHz. The significant difference between these two frequency bands lies in the ability to support Non-Line-of-Sight (NLOS) operation in the lower frequencies, something that is not possible in higher bands. Every wireless network operates fundamentally in a shared medium and, as such, requires a mechanism for controlling access by subscriber units to the medium. The 802.16a standard uses a slotted TDMA protocol scheduled by the BTS (Broadband Wireless Access) to allocate capacity to subscribers in a point-to-multipoint network topology. By starting with a TDMA approach with intelligent scheduling, WiMAX systems will be able to deliver not only high speed data with SLAs, but latency sensitive services such as voice and video or database access. The standard delivers QoS beyond mere prioritization, a technique that is very limited in effectiveness as traffic load and the number of subscribers increase. The MAC layer in WiMAX certified systems has also been designed to address the harsh physical layer environment where interference, fast fading, and other phenomena are prevalent in outdoor operation. The IEEE 802.16a standard specifies channel sizes ranging from 1.75MHz up to 20MHz with many options in between. This includes license exempt bands of 2.4GHz ISM, 5GHz ISM and 5GHz.

Coverage

The BWA standard is designed for optimal performance in all types of propagation environments, including LOS, near LOS and NLOS environments. It delivers reliable robust performance even in cases where extreme link pathologies have been introduced. The robust OFDM waveform supports high spectral efficiency (bits per second per Hertz) over ranges from 2 to 40 kilometers with up to 70 Mbps in a single RF channel. Advanced topologies (mesh networks) and antenna techniques (beam-forming, STC, antenna diversity) can be employed to improve coverage even further. These techniques can also be used to increase spectral efficiency, capacity, reuse, and average and peak throughput per RF channel. Not all OFDM is the same. The OFDM designed for BWA has in it the ability to support longer range transmissions and the multi-path or reflections encountered.

WiMAX FEATURES	
TDM/TDMA Scheduled Uplink/Downlink frames.	Efficient bandwidth usage
Scalable from 1 to hundreds of subscribers	Allows cost effective deployments by supporting enough subscribers to deliver a robust business case
Connection-oriented	Per Connection QoS Faster packet routing and forwarding
QoS support Continuous Grant Real Time Variable Bit	Low latency for delay sensitive services (TDM Voice, VoIP)
Rate Non Real Time Variable Bit Rate Best Effort	Optimal transport for VBR traffic (e.g., video) Data prioritization
Automatic Retransmission request (ARQ)	Improves end-to-end performance by hiding RF layer-induced errors from upper layer protocols
Support for adaptive modulation	Enables highest data rates allowed by channel conditions, improving system capacity
Security and encryption (Triple DES)	Protects user privacy
Automatic Power control	Cellular deployments minimize self interference

Cellular (CDMA)

CDMA is a new cellular technology that would provide high speed broadband data services. This new standard is called CDMA2000. CDMA2000 is designed to provide true 3G services to its end users. Key requirements for providing 3G multimedia services include high-speed packet data capability, spectrum efficiency to support large volumes of data, the ability to offer multiple services to the same user simultaneously, and Quality of Service (QoS) control to manage access, priority, and application-specific requirements for various services. These services may include conferencing, video clips, Voice-over-IP (VoIP), simultaneous voice and data services, pictures, news, e-mail, Internet and Intranet, location-based services, telematics services, and so on.

This new wireless standard promises increased capacity and high-speed data application for up to two megabits. Third generation wireless employs wideband frequency carriers and a CDMA air interface. Networks will be able to transmit wireless data at 144 kilobits per second at mobile user speeds. Implemented in Europe as UMTS and CDMA2000 in North America, its goals are high-quality multimedia and advanced global roaming (in house, cellular, satellite, etc.).

NNI (Network to Network Interface)

NNI interface will be used whenever another service provider provides a local access interface to another state or federal government's private IP network.

VTN SERVICES

VTN compatibility features will provide many new services which are cataloged as:

Access Types

Frame Relay

- ATM
- Private Line
- Public Internet through level 3 VPNs
- ISDN
- Analog Dial Access

Port Speeds

56/64kbps

- 128kbps, 192kbps 256kbps, 384kbps, 512kbps, 768kbps, and 1.024mbps through T1 local loop
- T1
- 3mbps, 4.5mbps, 6mbps and 9mbps through multiple T1 local loops
- 3mbps, 4mbps, 6mbps, 9mbps, 12mbps, 15mbps, 18mbps, 21mbps, 24mbps, 27mbps, 30mbps, 36mbps and 39mbps through DS3 local loop
- DS-3
- OC-3
- OC-12

Encapsulation Supported

MLPPP (NxT1)

- Frame Relay
- ATM
- Sonet
- HDLC

Features

Traffic Management through QoS based on DeffServ Standards

- Load Sharing (Type of Diversity)
- IPv6
- Extranet
- IP Multicasting
- IP Video Bridging
- VoIP Bridging

Equipment Lease

VTN will provide Customer Perm Equipment (CPE) equipment if required and provide a lease rate. This rate would also provide installation, upgrades, replacement and maintenance.

IT Features

- IP Directory (list of all devices on the network)
- Calendaring and Scheduling

Business Case

INTRODUCTION

The VTN Pro Forma Summary chart (p. 58) describes the attached Business Case in Excel format. This document will review the following items.

- Business Case Review
- Forecast
  - Classification of locations
  - Services forecast
  - Bandwidth forecast

BUSINESS CASE REVIEW

The VTN Pro Forma Summary from the detailed Business Case workbook, see Appendix D, depicts VTN start-up and operations years 1 through 5.

VTN Pro Forma Summary

	Year 1	Year 2	Year 3	Year 4	Year 5
Revenues/Appropriation					
Distance Learning					
Telemedicine	441,635	1,245,638	2,307,362	4,022,309	7,504,460
Total Revenues					
Expenses/Expenditures					
Capital Cost	1,853,763	1,545,000	1,598,544	1,923,976	3,032,607
Variable Costs	389,366	909,656	794,153	1,255,057	1,246,607
Transmission cost (Leased)	92,000	196,000	284,000	476,000	568,000
Salaries	536,375	739,023	749,864	840,218	723,378
Total Expenses					
Earnings before interest and depreciation Including Capital Not Included	(1,893,493)	(1,405,017)	(369,335)	367,276	2,657,246
Earnings before interest and depreciation Not Including Capital	(484,106)	(403,041)	763,345	1,927,034	5,534,475
Less: Debt Amount	1,751,186	1,566,900	1,694,289	2,159,978	0
Interest Expense	83,181	157,609	238,088	340,687	378,408
Principal Repayment	175,119	331,809	501,238	717,235	796,648
10% Grant Amount	194,576	174,100	188,254	239,998	0
Net Cash Flow	(547,829)	(718,358)	212,274	633,110	758,812
Grant Money Requirements	547,829	718,358			

Note: **The estimated rates do not include local Loop rates**. These rates also do not include local access equipment if required. This would be the case if a local loop provider could not supply the proper access facilities to remote VTSAP sites.

The VTN project is requesting 4 years of Rural Utilities Services (RUS) Grant/Loan funding support for a total of $7.2M. Other grant support of $1.3M is requested as a state appropriation for the first two years. By the end of the third year the VTN would no longer require state support. By year Five the VTN would no longer require RUS grant support. The VTN would be self sustaining by year Five and would still be expanding the network to accommodate new customers.

Please note that all RUS funds MUST be used for rural requirements ONLY. Funding for urban sites is still under investigation.

Fixed & Variable Cost

The VTN cost model pulls all the detail information for all cost elements and summarizes it in on the VTN Pro Forma sheet. This cost model covers ten years of VTN operations. The following table shows the first two years of operations. The attached Excel file (electronic format only) shows ten years of VTN fixed and variable costs.

Cost elements:

- Fixed capital investment
  - Equipment cost by location
  - Network management requirements
  - CPE equipment cost (To be leased back to the customer)
  - Shipping, taxes and installation
- Fixed operating costs (Including benefits)
  - Staff
  - Engineering
  - Service and Operations
- Variable Cost
  - Equipment maintenance
  - POP lease rate.
  - Operational cost (Office rent, PCs and others)
  - System maintenance

The VTN Cost Model chart (pp. 59 & 60) shows the operational costs for the first two years. To view cost projections for ten years out please see Appendix D (electronic format only).

VTN Cost Model

	Year 1			Year 2		
Fixed Capital Investment	Unit Cost	**Qty**	**Extended Cost**	Unit Cost	**Qty**	**Extended Cost**
Equipment Cost by Location	-			-		
VTAP	$251,030	1	**$251,030**	$251,030	1	**$251,030**
VTSAP	$114,840	2	**$229,680**	$114,840	3	**$344,520**
Other Equipment	$6,000	1	**$6,000**	$6,000	1	**$6,000**
Video Bridging Equipment	$150,000	1	**$150,000**	$20,000	1	**$20,000**
Equipment Total			**$636,710**			**$621,550**

Telemedicine Site Equipment Cost						
Per site cost	$16,700	7	$116,900	$16,700	3.5	$58,450
Telemedicine Home Equipment Cost						
Per site cost	$6,500	30	$195,000	$6,500	20	$130,000
Base station cost	$120,000	1	$120,000	$120,000	0	$0
Network Management equipment						
Network Management Equipment	$120,000	1	**$120,000**	$30,000	1	**$30,000**
Software	$75,000	1	**$75,000**	$75,000	1	**$75,000**
Service Management Total			**$195,000**			**$105,000**
Fixed Equipment Capital SubTotal			**$1,188,610**			**$840,000**
			$0			
Shipping	5%		$47,431			$39,250
Installation	20%		$174,722			$124,310
Total Fixed Capital Investment			**$1,410,763**			**$1,003,560**
Total Software Cost			**$75,000**			**$75,000**
	Start UP Year 1			**Year 2**		
Staff and Contractor Costs	**Headcount Cost/yr**	**Head-count**	**Extended Cost/yr**	**Headcount Cost/yr**	**Head-count**	**Extended Cost/yr**
Staff						
Management (Salary)	$87,500	1.0	$87,500	$91,000	1.0	$91,000
Admin/Analyst (Salary)	$50,000	-	$0	$52,000	0.5	$26,000
Billing/Account Receivable Analyst (Salary)	$56,250	0.5	$28,125	$58,500	1.0	$58,500
Sales/Customer support specialist (Contractor)	$74,750	1.0	$74,750	$77,740	1.0	$77,740
Marketing support specialist (Contractor)	$74,750	1.0	$74,750	$84,083	1.0	$84,083
	Start UP Year 1				**Year 2**	
Engineering						
Senior Engineer/Engineering Manager (Contractor)	$109,250	1.0	$109,250	$113,620	1.0	$113,620
Router Engineer (contractor)	$86,250	1.0	$86,250	$89,700	1.0	$89,700
Backbone Engineer (Contractor)	$80,500	-	$0	$83,720	1.0	$83,720
Network Technician (Contractor)	$57,500	3.0	$172,500	$59,800	3.0	$179,400
Services & Operations						
Senior Services and Operations Engineer/Mgr (Contractor)	$103,500	1.0	$103,500	$107,640	1.0	$107,640
Senior IT System Engineer (Contractor)	$97,750	1.0	$97,750	$101,660	1.0	$101,660
Ops/Site Survey Tech	$57,500	1.0	$57,500	$59,800	3.0	$179,400
Total Staff Cost		**6.5**	**523,875.0**		**9.5**	**726,023.4**
Total Contractor Capital Cost		**5.0**	**368,000.0**		**6.0**	**466,440.0**
	Year 1			**Year 2**		
Variable Costs	**Unit Cost/yr**	**Qty**	**Extended Cost/yr**	**Unit Cost/yr**	**Qty**	**Extended cumm. Cost**

Equipment Maintenance Service						
VTAP	$62,758	1	$62,758	$62,758	2	$125,515
VTSAP	$57,420	2	$114,840	$57,420	5	$287,100
Other	$1,500	1	$1,500	$1,500	1	$1,500
Video Bridging Equipment	$22,500	1	$22,500	$3,000	1	$3,000
Telehealth Site	$835	7	$5,845	$835	11	$8,768
Home Telehealth Base Station	$18,000	1	$18,000	$18,000	1	$18,000
Home Telehealth Site	$325	30	$9,750	$6,500	50	$325,000
Equipment Total			**$235,193**			**$768,883**
POP Lease		3	**$20,400**		7	**$42,000**
Operation Cost	$65,023	1	**$65,023**	$65,023	1	**$65,023**
System Maintenance/Support						
System Maintenance (Annual)	$25,000	1	$25,000	$7,500	1	$7,500
Equipment	$25,000	1	$25,000	$7,500	1	$7,500
Other Supporting Software	$18,750	1	$18,750	$18,750	1	$18,750
System Total			**$68,750**			**$33,750**
Total Variable Cost [3]			**$389,366**			**$909,656**

Equipment by Location

Budgetary cost for the following item.

- Equipment for VTAP and VTSAP sites
- Video Bridge/ Web Meeting and Scheduler Equipment
- Software for billing, network management, and others
- Network management Equipment
- Telehealth CPE equipment
- Home Health Monitoring equipment
- Facilities

Revenue Forecast

This section provides the revenue forecast by type of site for access to the VTN network. Revenues numbers for Video Bridging, Web Meeting, equipment rental and other services are depicted in the chart below. The first three years of revenue are provided in the Revenue Model. See Appendix D for the complete revenue forecast for ten years out (electronic format only).

This Revenue Model is built on assumptions based on the Capacity Forecast (see page 69).

Revenue Model

Revenue Category	Year 1	Year 2	Year 3
POP 1			
Number of Circuits	-	1	1
Average Monthly Revenue per Circuit	$8,000	$8,000	$8,000
One-time Installation Revenue per Circuit	$5,000	$5,000	$5,000
Yearly Subtotal	**$0**	**$69,000**	**$69,000**

POP 2			
Number of Circuits	2	4	10
Average Monthly Revenue per Circuit	$4,000	$4,000	$4,000
One-time Installation Revenue per Circuit	$3,000	$3,000	$3,000
Yearly Subtotal	**$54,000**	**$140,000**	**$350,000**
POP 3			
Number of Circuits	3	2	5
Average Monthly Revenue per Circuit	$1,500	$1,500	$1,500
One-time Installation Revenue per Circuit	$2,000	$2,000	$2,000
Yearly Subtotal	**$33,000**	**$28,000**	**$70,000**
REMOTE SITE 1			
Number of Circuits	10	20	45
Average Monthly Revenue per Circuit	$1,100	$1,100	$1,100
One-time Installation Revenue per Circuit	$1,500	$1,500	$1,500
Yearly Subtotal	**$81,000**	**$206,000**	**$463,500**
REMOTE SITE 2			
Number of Circuits	10	20	35
Average Monthly Revenue per Circuit	$400	$400	$400
One-time Installation Revenue per Circuit	$100	$100	$100
Yearly Subtotal	**$25,000**	**$66,000**	**$115,500**
REMOTE SITE 3			
Number of Circuits	40	60	110
Average Monthly Revenue per Circuit	$20	$10	$10
One-time Installation Revenue per Circuit	$20	$20	$20
Yearly Subtotal	**$5,600**	**$6,000**	**$11,000**
Category Yearly Total	**$198,600**	**$515,000**	**$1,079,000**
Number of clients	20	40	60
Total Hours Per Year	1,200	4,800	7,200
Price Per Hour	$ 80	$ 80	$ 80
Category Total	**$96,000**	**$384,000**	**$576,000**
Number of Clients	20	40	80
Total number of sessions per year	1200.00	4800.00	9600.00
Price Per Sessions	$ 2	$ 2	$ 2
Category Total	**$2,400**	**$9,600**	**$19,200**
Number of Sites	7	11	16
Average Monthly Revenue per Site	$ 557	$ 557	$ 557
One-time Installation Revenue per Circuit	$ 3,340	$ 3,340	$ 3,340
Category Total	**$ 46,760**	**$ 81,830**	**$ 122,745**
Number of Sites	30	50	100
Average Monthly Revenue per Site	$ 460	$ 460	$ 460
One-time Installation Revenue per Circuit	$ 500	$ 500	$ 500
Category Total	**$ 97,875**	**$ 255,208**	**$ 510,417**
Total Projected Revenue (4)	**$441,635**	**$1,245,638**	**$2,307,362**

Headcount Assumption

This headcount assumption chart, based on full-time equivalent (FTE = 2080/ hr/yr) provides staffing requirement projections for engineering, services and operations personnel.

- Position
  - Salary
  - Contractor
- Headcount per position
- % requirement for this project
- Base
- Benefits
- Annual headcount cost % increase
- Total per position
- Total for salaried positions
- Total for contractor positions
- Total for staff
- Total for engineering
- Total for services & operations

The FTEs Assumptions table (pp. 63-66) depicts staff projections for the first 3 years of VTN operations. Ten year projections are available in Appendix D (electronic format only).

FTEs ASSUMPTIONS	**Start Up Year 1**	**Year 2**	**Year 3**
Staff			
Management (Salary)			
Headcount	1.0	1.0	1.0
% required	100%	100%	100%
Base	$70,000	$72,800	$75,712
Benefits	25%	25%	25%
Annual Headcount Cost % Increase	0%	4%	4%
Total	$87,500	$91,000	$94,640
Staff			
Admin/Analyst (Salary)			
Headcount	-	0.5	1.0
% required	100%	100%	100%
Base	$40,000	$41,600	$43,264
Benefits	25%	25%	25%
Annual Headcount Cost % Increase	0%	4%	4%
Total	$0	$26,000	$54,080

Staff			
Billing/Account Receivable Analyst (Salary)			
Headcount	0.5	1.0	1.0
% required	100%	100%	100%
Base	$45,000	$46,800	$48,672
Benefits	25%	25%	25%
Annual Headcount Cost % Increase	0%	4%	4%
Total	$28,125	$58,500	$60,840
Staff			
Sales/Customer support specialist (Contractor)			
Headcount	1.0	1.0	1.0
% required	100%	100%	100%
Base	$65,000	$67,600	$70,304
Benefits	15%	15%	15%
Annual Headcount Cost % Increase	0%	4%	4%
Total	$74,750	$77,740	$80,850
Staff			
Marketing support specialist (Contractor)			
Headcount	1.0	1.0	1.0
% required	100%	100%	100%
Base	$65,000	$67,600	$70,304
Benefits	15%	15%	15%
Annual Headcount Cost % Increase	0%	4%	4%
Total	$74,750	$77,740	$80,850
Engineering			
Senior Engineer/Engineering Manager (Contractor)			
Headcount	1.0	1.0	1.0
% required	100%	100%	100%
Base	$95,000	$98,800	$102,752
Benefits	15%	15%	15%
Annual Headcount Cost % Increase	0%	4%	4%
Total	$109,250	$113,620	$118,165
Engineering			
Router Engineer (contractor)			
Headcount	1.0	1.0	1.0
% required	100%	100%	100%
Base	$75,000	$78,000	$81,120
Benefits	15%	15%	15%
Annual Headcount Cost % Increase	0%	4%	4%
Total	$86,250	$89,700	$93,288

Engineering			
Backbone Engineer (Contractor)			
Headcount	-	1.0	1.0
% required	100%	100%	100%
Base	$70,000	$72,800	$75,712
Benefits	15%	15%	15%
Annual Headcount Cost % Increase	0%	4%	4%
Total	$0	$83,720	$87,069
Engineering			
Network Technician (Contractor)			
Headcount	3.0	3.0	3.0
% required	100%	100%	100%
Base	$50,000	$52,000	$54,080
Benefits	15%	15%	15%
Annual Headcount Cost % Increase	0%	4%	4%
Total	$172,500	$179,400	$186,576
Services and Operations			
Senior Services and Operations Engineer/Mgr (Contractor)			
Headcount	1.0	1.0	1.0
% required	100%	100%	100%
Base	$90,000	$93,600	$97,344
Benefits	15%	15%	15%
Annual Headcount Cost % Increase	0%	4%	4%
Total	$103,500	$107,640	$111,946
Services and Operations			
Senior IT System Engineer (Contractor)			
Headcount	1.0	1.0	1.0
% required	100%	100%	100%
Base	$85,000	$88,400	$91,936
Benefits	15%	15%	15%
Annual Headcount Cost % Increase	0%	4%	4%
Total	$97,750	$101,660	$105,726
Services and Operations			
Programmer Analyst			
Headcount	1.0	1.0	1.0
% required	100%	100%	100%
Base	$65,000	$67,600	$70,304
Benefits	15%	15%	15%
Annual Headcount Cost % Increase	0%	4%	4%
Total	$74,750	$77,740	$80,850
Services and Operations			
Ops/Site Survey Tech			
Headcount	1.0	3.0	3.0

% required	100%	100%	100%
Base	$50,000	$52,000	$32,000
Benefits	15%	15%	15%
Annual Headcount Cost % Increase	0%	4%	4%
Total	$57,500	$179,400	$110,400
Salaried Total	$115,625	$175,500	$209,560
Contractor Total	$851,000	$932,880	$894,019
Staff Total	$265,125	$253,240	$290,410
Engineering Total	$368,000	$466,440	$485,098
Services Operation	$333,500	$466,440	$408,922
GRAND TOTAL	**$966,625**	**$1,186,120**	**$1,184,429**

FORECAST

Forecast information is used to predict which services would be required and the amount of revenue that would be generated per year. Forecasting is also used to predict internode bandwidth requirements.

Classification of Locations

Location classifications are use to classify each sites' location by bandwidth, telecommunication services, and traffic patterns. From this information forecasts can be developed for:

- Facilities
- Revenue
- Backbone requirements
- Backbone site factoring in equipment sizing
- Number of backbone sites

This classification scheme results in 6 different types of location with three classes for large locations called MOS (Major Operating Sites) and three classes of remote sites referred to as ROS (Remote Operating Sites).

MOS locations are sites that require access speeds greater than a T1 (1.544mbps). ROS sites require access speeds less than T1 speeds.

Description of Classes

Type/Class
MOS or ROS

Type of Location

Facilities or Organizations include: Medical Teaching Hospitals, Tertiary Hospitals, Secondary Hospitals, Community Access Hospitals, Federally Qualified Health Clinics, Free Clinics, Assisted Living Centers, Nursing Homes, Skilled Nursing Facilities, Hospices, Area Agencies on Aging centers, Area Health Education Centers, Virginia Department of Health State District Offices, Community Services Boards, Behavioral Health Authority Sites, Social Services Centers, Dental Offices, Physicians' Offices, Physicians' homes, Patients' homes, Auxiliary and Support Services, Laboratories, and Pharmacies.

Provider/Receiver

A "Provider" is a location in which some type of service is provided to a remote location. A "Receiver" is a location which is receiving some type of service from a provider. An example would be a major university that is providing telemedicine services to a remote or rural location that is receiving those services.

A site can be both a provider as well as a receiver. An example would be a rural clinic that has a need to utilize a telemedicine application that is not available on site and can be delivered using teleconnectivity from a provider site. There will be occasions in which a clinic may provide telemedicine to a different location (for example: nursing homes).

Technology Requirements
Describe the types of telecommunication services required at each location.

These services include:

- IP – Video conference
- IP – Video/Voice bridge services
- IP – Multicasting
- IP- VoIP (Voice)
- Email (secured)

Security Requirements

All locations will require data and image encryption to comply with HIPAA requirements and to provide confidentiality for patients. Recondition is to follow all HL7 reconditions in the electronic transport of patient information. However, not all information will need to be encrypted; for example, public health and patient education materials will not require HL7 security levels. In the long run, it may be easier and more

cost-effective to encrypt all data than to separate out data that does not require encryption. This would include all telecommunication services listed under the technology requirements.

Traffic Patterns

The traffic patterns are classified as either "Point-to-Point" or "Point-to-Multipoint". Point-to-Point traffic patterns are used by locations that require talking to only one location at one time, for example a remote doctor and patient consultation would need Point-to-Point connectivity.

A Point-to-Multipoint location would require connectivity to "talk" to multiple locations simultaneously, for example in an educational environment (teacher to students) or during a public health alert (VDH to physicians' offices). Each of these situations requires either a multicasting function or video conference bridge.

Bandwidth Requirements

The bandwidth requirements are determined by local access availability. Bandwidths are described as:

- OC3 or OC12- very high speed which is SONET based. There are no requirements for any location to need this type of bandwidth; however as demand grows and new telemedicine applications become commonplace, this level of bandwidth will become necessary.
- Subrate DS-3 to DS-3 (45mbps) - note that the access would be DS-3 but the network bandwidth requirements could be somewhat less then that called Subrate DS-3. This includes bandwidth requirements with speeds greater then 8mbps and up to a full DS-3 speed.
- T1 to NxT1 – Where "N" is equal to the number of T1s to provide total bandwidth such as 3, 4.5, 6 and up to 9mbps speeds.
- T1 (1.544mbps)
- NxDS0 to T1 where "N" is equal to the number of 64kbps times "N". In most cases, local access would be T1 but the network requirements will be less than a full T1 of bandwidth.
- DSL- Analog (Dial) - access is for the most remote sites where digital access is not possible.

This table (pp. 67 & 68) contains location classes and how they differ from each other by services, technology and security requirements, traffic patterns, and bandwidth.

Type Class	Type of Location	Services Required	Provider (P) Receiver (R)	Technology Requirements	Security	Traffic Patterns	Bandwidth Requirements
MOS - 1	Large universities and medical centers ex.	TeleHealth Tele-education	Provider Only	IP – Video Conference IP – Video/Voice Bridge	Have both	P to P - High P to MP - High	OC-12 & OC-3

	VDH, UVA and VCU			IP – Multicasting IP- VoIP (Voice) Email			
MOS - 2	Major location for Data Traffic site like VDH, UVA, VCU and other large Medical Facility	TeleHealth Tele-education	Provider – High Receiver - Low	IP – Video Conference IP – Video/Voice Bridge IP – Multicasting IP- VoIP (Voice) Email	Have both	P to P - High P to MP - High	DS-3 to Subrate DS-3
MOS - 3	Hospitals	TeleHealth Tele-education	Provider – High Receiver - Medium	IP – Video Conference IP – Video/Voice Bridge IP – Multicasting IP- VoIP (Voice) Email	Have both	P to P - High P to MP - Medium	NxT1 , T1
ROS - 1	Rural Medical Facility and large Clinics	TeleHealth Tele-education	Provider – High Receiver - High	IP – Video Conference IP – Video/Voice Bridge IP – Multicasting IP- VoIP (Voice) IP – Voice Email	Have both	P to P - High P to MP - Low	T1
ROS - 2	Small Rural Clinics	TeleHealth Tele-education	Receiver Only	IP – Video Conference IP – Video/Voice Bridge IP – Multicasting IP- VoIP (Voice) IP – Voice Email	Encryption required only	P to P - High P to MP - Low	T1 to NxDS0
ROS - 3	Home location and very small Clinic	Telehealth Tele-education	Receiver Only	IP – Video Conference Email	Encryption required only	P to P - High P to MP - None	DSL and Analog (Dial)

Backbone Bandwidth Forecast

The following forecast was generated by using the above table with the following data:

- Data from 270 known sites in addition to a list of possible sites that could be added to the Network,
- The maximum amount of sites that could be installed in one year, and
- Dates of broadband access availability in rural areas of Virginia.

The Capacity Forecast table depicts the first 2 years of VTN operations. Please see Appendix D to view the ten years out Capacity Forecast (electronic format only).

Capacity Forecast

			Year one		Year two	
Class of Location	**SPEED**	**mbps**	**Number of Sites**	**Total Bandwidth**	**Number of Sites**	**Total Bandwidth**
POP-1	OC-3	155	0	0	1	77.5
POP-2	DS-3	45	2	45	4	90
POP-3	N* T1	3	3	4.5	2	3
Remote Site 1	T1	1.544	10	7.72	20	15.44
Remote Site 2	384KBPS	0.384	10	1.92	20	3.84
Remote Site 3	56KBPS	0.056	40	1.12	60	1.68
		Total	**65**	**60**	**107**	**191**
BACKBONE REQUIRMENTS				**DS3**		**2xDS3**

The above table shows that the backbone bandwidth requirements are as follows:

5) Year one – **DS3**
6) Year two – **2 x DS3**
7) Year three – **OC12**
8) Year four – **2 x OC12**

The total amount of sites on the network are projected as:

5) Year one – 65 sites at a roll-out rate of 6 sites per month. Note that most sites are dial lines.
6) Year two – 42 new sites for a total of 107 sites – roll-out rate: 11 sites per month. This requires more T1's because of dial sites migrating to digital facilities as they become available.
7) Year three – 99 new sites for a total of 206 sites – with greater migration to higher bandwidth speeds due to more intense applications
8) Year Four – 147 new sites for a total of 353 sites –bandwidth requirements should increase substantially thereafter as more locations will require greater bandwidth for new services and telemedicine applications.

Estimated VTN Port Pricing		
Speed	**Non-Rural**	**Rural**
56kbps Dial	**$20**	**$ 10 to Free**
DS-1	**$1,300**	**$1000**
DS-3	**$2,300**	**$2,000**

Note:
The estimated Port rates do not include Local Loop (Access) rates or any FCC discounts that may be available.

VTN Governance, Administration & Oversight

The Task Force investigated several governance models that would further the mission of the Virginia Telehealth Network Strategic Plan. The model needed to be philosophically compatible with the mission, goals, and membership of the VTN. The governance model would be required to facilitate the successful attainment of the goals to the satisfaction of VTN membership and underwriters. The Task Force considered including a request for legislative support to form a Virginia Authority to govern the VTN Enterprise.

The following considerations guided the Task Force's analysis and recommendations for Network policy and operations: Governance (Legal Authority and Policy Making) and Management (Strategy and Operations) must be compatible.

- Governance could come from the following sources: end-users, subscribers, underwriters/funders, the Virginia legislature, a voluntary coalition, an appointed or elected advisory group, or a combination of the above.
- Management should come from the governance authority; it could be contracted, hired, or conducted by a consensus of volunteers.

The following principals should guide the choice of the governance and management structure.

- Maximize revenue streams (allowable sources of revenue)
- Maximize revenue and cost recovery through the Universal Services Fund
- Maintain control over activities and equipment including pooled leasing of medical digital equipment, telemedicine site specific equipment acquired through VTN activities, and the broadband infrastructure which makes possible the list of services delineated throughout the Strategic Plan.
- Not duplicate existing equipment, infrastructure, or services
- Base operations on rational analysis of needs and readiness and apply proper business processes and methodologies
- Adopt user-driven policies and practices
- Provide measurable value to customers through setting appropriate benchmarks, practicing transparent management protocols, and submitting regular reports that measure service utilization and customer satisfaction
- Minimize economic and marketplace risk for lease-holders and loan signatories.

1. Recommend VTN governance begins with volunteer representation by VTN end-users and interested parties; and transition to representative Board of end-users within 12 months.

2. Recommend retention of select Task Force members and hired contractors for VTN management team to maintain continuity through for first two years' planning, marketing, start-up, transition, evaluation and reporting periods.

Ownership Structures

There are three different types of ownership structures: private, public and collective. The Task force recommends choosing a legal structure that is consistent with the funding needed for start-up and demonstration projects. The ownership structure should facilitate the creation of a broad array of telecommunications and medical digital services for revenue generation. For-profit organizations are often ineligible to receive philanthropic funds and soft loans. Nonprofit organizations, on the other hand, have difficulty obtaining commercial funds. In this case, the legal status of VTN should be guided by consideration for the most suitable type of funding.

Advantages and disadvantages of each type of ownership structure:

Public ownership decision-making and participation may be affected if the company ceases to provide services or goes out of business. Public ownership becomes a legal issue if the owner(s) wants to sell the social enterprise, or close it and liquidates the assets.

Private ownership offers benefits of equity financing, unambiguous asset ownership and valuation, and the freedom to sell the enterprise. Conflict can arise between fundamental motives of profit-making and mission. For-profits must minimally breakeven and often have tax liabilities, limiting their type and purpose to more productive and financially driven models than those that may serve a social need, yet run at a deficit.

Nonprofit cooperatives are driven by their social mission; most cooperatives are incorporated similar to other types of nonprofits, and are thus entitled to similar benefits and limited by similar restrictions. In practice, owners are "members" of the nonprofit cooperative and though they may have programmatic and business decision-making authority and realize certain advantages, they do not actually own the brand, infrastructure, assets, methodology, programs, revenue, etc. and do not enjoy private property ownership rights.

Each of these methods presents opportunities and challenges to establishing the optimal governance and management structure for the Virginia Telehealth Network. The Task Force evaluated two approaches to establish a nonprofit governance structure that are compatible with the guiding principals delineated above.

- In Virginia, this is a nonstock corporation that will require approval of its bylaws by the Virginia Telehealth Network membership. Once the bylaws are approved, the organization can file with the State Corporation Commission as a nonprofit organization legally obliged to conduct business in the Commonwealth. Next, to maximize funding sources, the VTN Corporation files with the IRS requesting nonprofit status under Section 501 (c) 3 of the IRS Code. This corporation could, through its bylaws, adopt either an ownership structure similar to cooperative agreements or some combination of ownership and advisory structure to oversee contracts, and monitor utilization.

- Request the Virginia Legislature to form a Legal Authority which will have nonprofit status in Virginia and will meet IRS Code for nonprofit status. The VTN voluntary membership have expressed their desire that the VTN be governed by its end-users and unencumbered from direct political representation, and so the legal Authority option was ruled out to make the service delivery model market sensitive and to exploit market conditions that will be created by aggregating various end-users for a variety of Network services features.

Fundamental Business Models of Nonprofit Organizations:

- Entrepreneur Support-- sells business support and financial services to target population or "clients," self-employed individuals or firms.
- Market Intermediary-- provides services to its target population or "clients," small producers (individuals, firm or cooperatives), to help them access markets.
- Fee-for-Service-- commercializes social services, and then sells them directly to the target populations or "clients," individuals, firms, communities, or to a third party payer.
- Service Subsidization-- sells products or services to an external market and uses the income it generates to fund its programs.
- Market Linkage-- facilitates trade relationships between the target population or "clients," small producers, local firms and cooperatives, and the external market.
- Organizational Support-- sells products and services to an external market, businesses or general public.

Management Organization

A legally recognized organization should be developed to ensure that the VTN is capable of carrying out its mission to provide the highest quality service to end-users. This necessitates a core professional staff that has the requisite experience and expertise in the following functional areas:

- Engineering
- Operations and Services Support
- Marketing and Administration

VTN staffing levels and makeup should reflect Task Force recommendations to regionalize the VTN through phased demonstration and pilot projects based on healthcare needs and facility readiness. This approach yields viable investment-to-cost ratios until

increased service revenues are realized through economies of scale and group lease/purchase agreements are in effect.

When the organizational and telecommunications framework is fully developed the following staffing and management configurations will be as follows: the engineering staff will have responsibility for the design, development, and provisioning of the VTN network infrastructure. The staff will include:

Senior engineer/engineering manager will have primary responsibility for and oversight of:

- VTN network infrastructure
- Engineer staff management/hiring
- Coordinate with other functional groups

Senior Engineer/Engineering Manager will supervise the following staff:

- Router engineer - program and maintain VTN routers
- Backbone engineer – Install and maintain VTN backbone
- Network technicians (2) – Install and maintain VTN equipment

The operations and services support staff will have responsibility for 24/7 customer support, development and maintenance of VTN network systems and services. Senior Operations and Services Support Manager will have primary responsibility for and oversight of:

- VTN services design, implementation and customer support
- Hiring and management of operations and support staff
- Coordinate with other functional groups.

The Senior Operations and Services Support Manager will supervise the following staff:

- Senior IT system Engineer - Program and maintain video calendaring , network management systems
- Programmer Analyst - Program and maintain VTN web portal support VTN calendaring and network management software.
- Operations Technicians (2) – 24/7 incident response and site surveys

The marketing and administration staff will have responsibility for customer recruitment, retention and services design in response to end-user requirements. In addition, the marketing and administration staff will be responsible for VTN financial operations and general administration.

The VTN Manager will have primary responsibility for:

- VTN management
- Liaison with governance board /legislative bodies
- Fund raising/marketing

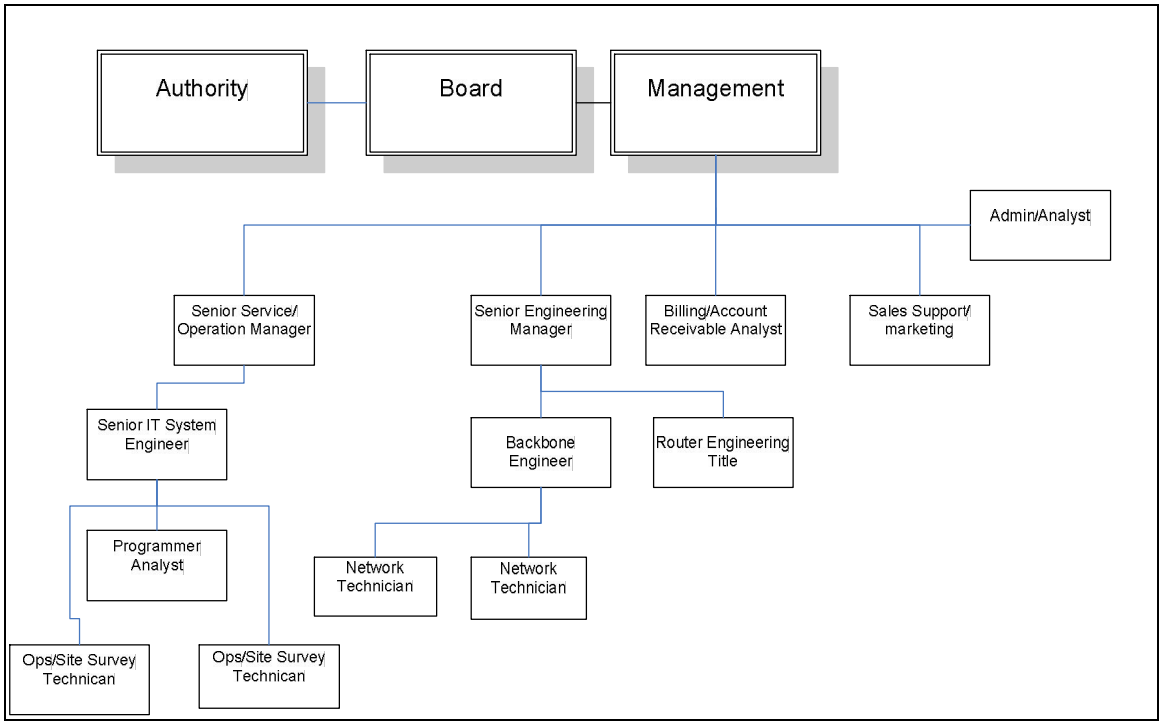
The VTN Manager will also supervise the following staff: Marketing/Customer Support Specialist, which

- Supports VTN sales and marketing activities
- Interfaces with VTN customers to gather feedback and ensure customer retention.

VTN Administrator will:

- Provide administrative support to VTN Staff and Board
- Maintain VTN portal static content
- Support VTN marketing
- Supervise Billing/Pricing Analyst, who will be responsible for
  - Billing and accounts payable
  - Creation of the VTN pricing structure

Virginia Telehealth Network Organizational Chart depicting Governance, Management, and Customer Services Structure



APPENDIX A

Description of Telehealth Applications

Telecommunications include such technologies as telephone, email, fax, Internet linkages, satellite, one-way and two-way video conferencing, and audio conferencing. Telecommunications are used across the nation to deliver conferences, corporate training, distance learning opportunities, health care services and health professional provider education. Telecommunication sites are usually located some distance from the host site or where the presenter may be located. Broadband telecommunication linkages allow for both one-way and two-way video conferencing and audio conferencing. Two-way or interactive video conferencing allows both the host site and the remote site(s) to see and communicate with each other. One-way video conferencing, however, does not allow for interaction between the connected sites. One site, normally the host site, provides information to the remote site, but cannot see the participants at the remote site. The telephone may be used for audio conferencing between the two sites. The use of telecommunications as tools for telehealth and telemedicine can greatly improve access to health care in the rural areas. In addition, telecommunication technology provides opportunities for CME and CEU activities for rural health care providers, health education to the general public, assistance with public school health services, and specialty medical consults. The utilization of telecommunications in health care delivery across the United States has increased in recent years.

Background

The Strategic Plan has its origins in the "Report of the Virginia Department of Health: Report on Telemedicine Initiatives, Senate Document No. 28, 2001". The Report was a consensus of the appropriations committees and the Joint Commission on Health Care to combine the language and intentions of both Senate Bill 1214 and Item 333 j of the 1999 Appropriation Act. Four primary barriers that confront telemedicine programs in Virginia were identified in the report:

- Lack of adequate reimbursement and financing;
- Technology integration needs;
- Operational design; and
- Physician acceptance of telemedicine.

To address the four identified barriers and to continue the evaluation process, the investigative team made the following recommendations to the State Health Commissioner:

- Use the recommended evaluation instruments to establish a baseline assessment of telemedicine programs in Virginia and initiate a continuous quality improvement and evaluation process;

- Continue the Telemedicine Program Working Group at the Virginia Department of Health to direct the continuing telemedicine evaluation. (This group could facilitate collaboration and development of Virginia's telemedicine initiatives and evaluate future needs, especially financing, and further opportunities for telemedicine initiatives by agencies of the Commonwealth);

- Virginia Department of Health sites should ensure integration of technology through the use of an integrator; and

- Involve communities, especially local physicians, in the development and support of telemedicine programs.

The most recent legislative report on telehealth was published in 2003, **"Improvements Need in Current Telemedicine Initiatives and Opportunities to Enhance Access and Quality," Document No. 28,** and was authored by George Mason University and the Virginia Department of Health.

The report discussed legislative initiatives to assure the growth of telemedicine and telehealth services and future comprehensive evaluation efforts. The report recommended that the first step towards reframing policy to support a well-developed and accountable telemedicine/telehealth infrastructure should be a comprehensive strategic planning process. Building on recommendations from previous telemedicine reports and current state and national trends, the following recommendations were made to keep Virginia moving forward:

- Implement a comprehensive and integrated statewide telemedicine/telehealth infrastructure strategic planning process;

- Establish and communicate the specific authorities and particular roles for state agency's committees, commissions, and work groups with respect to the physical infrastructure; existing telecommunication and health care resources within the state and functional infrastructure; and [other] administrative, bureaucratic, programmatic and political entities;

- Establish collaborative systems to ensure interoperability and operations among entities with authority and responsibility to process data and information;

- Coordinate processes for data information collection, management, reporting and dissemination using standardized frameworks and tools appropriate to the task for policy and program planning within each agency; and

- Create a framework for evaluation of future telemedicine/telehealth activities in the Commonwealth using mechanisms and elements drawn from prior evaluation frameworks described within this study.

VTN Telemedicine Site Survey

As was mentioned, during the fall of 2003, the Virginia Telehealth Network, under the sponsorship of the Virginia Department of Health, established an Infrastructure Work Group (IWG) in order to examine current telehealth capabilities in Virginia and identify future requirements.

As an initial step toward a comprehensive study of the telehealth environment in Virginia, the IWG designed a site survey to capture information about the adoption and status of telehealth utilization from a representative sample of health care facilities participating in the VTN. The site survey had two parts; (1) current telehealth network capacity and, (2) equipment and future plans for utilizing telehealth applications.

Survey Part 1

The first part of the site survey consisted of questions pertaining to the telecommunications network infrastructure. The purpose of these questions was to document the telecommunications network capacity at network sites. Specifically, respondents were asked to describe:

- Site network design with respect to;
    - Connection speed (ISDN, T1, DS3 etc.)
    - Network topography (spoke, wheel etc.)
    - Equipment (router, hub, switches etc.)
    - Video conferencing equipment
    - Telehealth specific equipment

Survey Part 2

The second part of the site survey consisted of a series of questions in which respondents were asked to list their current uses of telehealth and their plans (over the next 36 month period) for expanded use of telehealth:

- What telehealth services are available at this site?
- Does your site provide or require telemedicine capability (e.g. store and forward)?
- Does your site have the capacity to connect to other telemedicine networks within the state?
- Does your site require access to other telemedicine networks beyond those to which you are connected?
- Does your site have the capacity to connect to other telemedicine networks outside the state?
- Does your site have or require video bridging (conferencing) services?
- What upgrades are required for facilities and equipment in the next 36 months?
- What are the expansion plans for telemedicine/telehealth services at your site?

Site Survey Results

The site survey was distributed to VTN member organizations. Seventeen surveys were returned, wholly or partially completed. Survey respondents, a cross section of the telehealth sites in the state, represented current and potential future users of telehealth in Virginia. Respondents represented large medical teaching hospitals and academic institutions, private sector health care providers, state government health agencies, and rural health care facilities.

The survey results provided a basis for understanding the type, configuration, and varieties of telehealth facilities in Virginia, their technical environment, and future plans. The respondents were:

- Blue Ridge Regional Medical Center
- Buchanan General Hospital
- Edward Via Virginia College of Osteopathic Medicine (VCOM)
- Lewis-Gale Medical Center
- Louisville Medical Center
- Montgomery Regional Hospital
- Norton Community Hospital
- Pulaski Community Hospital
- Sentara Home Care Services
- Virginia Commonwealth University (VCU) Health System
- VCU Medical School
- Virginia Department of Health (VDH)
- Virginia Department of Mental Health Mental Retardation Substance Abuse Services (DMHMRSAS)
- Virginia Primary Care Association (VPCA)
- Veterans Administration Medical Center, Salem
- University of Virginia (UVA)
- Wythe County Community Hospital

APPENDIX B

Summary of Telehealth Programs in Virginia

University of Virginia Medical Center – Office of Telemedicine

The University of Virginia began development of their telemedicine program in 1993. Faculty of the Department of Neurosurgery conducted a demonstration of telemedicine and developed research and developmental studies related to telemedicine. The initial demonstrations linked UVA with two hospitals in two states. Using fiber optic lines and ATM switches, voice, video, and data were transferred among these three locations. Specialists at UVA were able to assist their colleagues at off-site locations. A new era of medicine evolved. The Central Virginia Telemedicine Network (CVTN) was launched in October 1994. This initiative was funded with a grant from Sprint and CFW Communications (now Ntelos) who donated fiber optic lines for the first year. UVA linked to Rockingham Memorial Hospital in Harrisonburg. A medical technology company, Multi-Media Medical Systems, developed its first telemedicine workstation called "HouseCall" in May 1995. UVA obtained its first workstation in December 1995 and by April 1996 installed its first off-site telemedicine system at the Augusta Medical Center in Fishersville.

In 1997, The University of Virginia Office of Telemedicine secured funding to form the **Southwest Virginia Alliance for Telemedicine.** Its mission was to provide telemedicine and telehealth services to four sites in Virginia. The initiative received funding from the United States Department of Commerce NTIA TIIAP (TOP) grant program, the Virginia Health Care Foundation, and corporate and foundation sponsors included Buchanan County, Verizon, Sprint, the Baxter Foundation, and the WestWind Foundation. In 1999, the project expanded to six sites when funding was secured from the Rural Utilities Service of the United States Department of Agriculture. Craig County Public Schools was added to the Alliance through funding provided by the WestWind Foundation. The UVA Office of Telemedicine developed an outreach project using advanced computer and telecommunication technologies to assist with health services in this rural school division. UVA telehealth/telemedicine initiatives have received funding from the Office for the Advancement of Telehealth and the Virginia Department of Health.

The **Southwest Virginia Alliance for Telemedicine** utilizes the statewide ATM network, called **Network Virginia**, for connectivity. Each of the remote sites in Virginia has a T1 connection, which is utilized for telemedicine, distance learning, and Internet access. The project strives to improve medical care in rural areas of Virginia by providing specialty clinical and consultative services via telemedicine. Patients who are unable to travel to distant sites for specialty care are benefitting from the **Southwest Alliance for Telemedicine**.

Tele-Mental Health Network

In 1995, through a three year federal Office of Rural Health Policy grant, the **Tele-Mental Health Network**, **Appal-Link Project** began providing clinical and support services between Cumberland Mountain Community Services Board in Cedar Bluff and the Southwestern Virginia Mental Health Institute in Marion. Within a few days after the start-up of the project, Dickenson County Community Services Board connected to the network. This was the first telepsychiatry project in Virginia and one of only six other projects in the nation testing telecommunications technology to deliver mental health care at a distance. Medication review, case consultation, discharge planning, commitment hearings, family visits and staff training activities were reported to occur daily over this network (Appal-Link Virginia, 2002).

The **Appal-Link** network expanded to include a total of ten sites: New River Valley Community Services Board in Blacksburg, Mt. Rogers Community Services Board in Wytheville, Highlands Community Services Board in Abingdon and Planning District One Community Services Board in Big Stone Gap, and the three original sites listed above. In April 1997, The Laurels, an alcohol and drug treatment program located in Lebanon became the eighth site. The program served a broad region and included seven counties. The network facilitated pre-admission reviews, case consultations with the referring Community Services Board, medication follow up, discharge planning and family visits. In order to provide effective mental health and substance abuse treatment, the family must be involved. When the facility is located a distance from the home, the family may not be able to afford to travel to the facility to take part in the treatment process. With the network connection in each Community Services Board community, family members can easily become an essential part of the treatment team through telecommunications, with minimal expenses for time and travel.

The Clearview Center, a twenty-bed inpatient psychiatric treatment center in Lebanon, became the ninth site in 1997. The Clearview Center is owned by Russell County Medical Center. Patients admitted to this facility have access to their families and community treatment providers. The Southwestern Virginia Training Center at Hillsville has also joined the network, bringing the total number of sites to ten.

Virginia Commonwealth University – Medical College of Virginia

Virginia Commonwealth University (VCU), Medical College of Virginia (MCV) uses telemedicine as an extension of distance learning activities conducted previously as audio conferences, using Plain Old Telephone Service (POTS), and satellite videoconferences broadcast by one-way video and two-way audio.

VCU's School of Medicine's first major telemedicine project began in July 1995 and involved the Blackstone Family Practice Center (BFPC), located in Blackstone, VA, 58 miles from the medical school's campus. The telemedicine link was created to provide medical education to medical students, residents and practitioners, as well as deliver specialty services to patients in a medically underserved geographic region. This site has been sold to another provider group and is no longer a residency program of VCU.

VCU's second telemedicine project involved the Virginia Department of Corrections (DOC) and the Powhatan Correctional Center, located 27 miles from the MCV Campus. Over 2,900 patient consultations were held between project implementation in October 1995, and July 2001, when the project was transferred to VCU Health System. During that period regular clinics were established for patients who needed specialty care for such problems as infectious disease and cardiology consultation; other specialty clinics, such as oral surgery screening and orthopedic surgery follow-up, were scheduled as required.

VCU reported that because of the success of the VCU School of Medicine telemedicine program with the patients at the Powhatan Correctional Center, the Virginia Department of Corrections expanded the Virginia Correctional Telemedicine program to include the University of Virginia Health System. In July 2001, after several years of successful patient care and follow-up, the health care delivery side of the VCU School of Medicine telemedicine project was transferred, as a successful model program, to the Department of Ambulatory Care Services under the umbrella of the VCU Health System.

The reader is directed to the Virginia Department of Health website http://www.vdh.virginia.gov/primcare/center/vtn/info.asp for links to a comprehensive history of telehealth initiatives in the Commonwealth.

Additional references

UVA – Office of Telemedicine
http://www.healthsystem.virginia.edu/internet/telemedicine/history/
VCU - http://www.medschool.vcu.edu/ofid/de_history.html
EVMS - http://www.evms.edu/cme/

APPENDIX C

Strategic Plan Task Force Biographies

The VTN Plan initiative is led by Kathy H. Wibberly, Ph.D., Senior Policy Analyst, Virginia Department of Health Office of Health Policy and Planning. The VTN Strategic Task Force includes Michael Aisenberg, J.D.; Ed Bostick, MPA; Peter Buccellatto, B.S. (Engineering and Information Technology); Rebecca Davis, Ph. D., Steve Gillis, M.S. (Information Systems Technology); David Heise, BSED; and Jay Sanders M.D., F.A.C.P., F.A.C.A.A.I.

Kathy Hsu Wibberly, Ph.D.

Kathy Hsu Wibberly, Ph.D. is a Policy Advisor in the Virginia Department of Health (VDH) Office of Health Policy and Planning (OHPP). While at VDH OHPP, she has provided leadership for several statewide projects, including the Virginia Partners in Prevention Initiative, the Virginia Right Choices for Youth Initiative, CLAS Act (an initiative to enhance the delivery of culturally and linguistically appropriate health care services), the Virginia Telehealth Network, and the Virginia State Planning Grant. Additionally, Kathy has had over eight years of experience working with the VDH Office of Family Health Services conducting program evaluation research and managing multi-site program evaluations using a multi-disciplinary team of research and program evaluation experts representing academic institutions from around the state. Kathy was instrumental in establishing an Institutional Review Board (IRB) at VDH and presently serves as its Chair. Before coming to VDH, Kathy was a Certified Prevention Specialist with the District 19 Community Services Board. Kathy also has professional work experience teaching and as an individual and group therapist in a variety of settings, including community mental health and adult and juvenile corrections. Kathy received her Ph.D. and M.S. from Virginia Commonwealth University in Counseling Psychology, specializing in group interventions. She graduated cum laude from Gordon College in Wenham, MA with a B.A. in Psychology and minors in pre-medicine and youth services.

Michael Aisenberg, J.D.

Michael Aisenberg, J.D. is Director of Government Relations for VeriSign in Washington, D.C. An attorney by training, Aisenberg leads the cyber security, authentication and critical infrastructure policy practice for the leading Internet infrastructure provider. He holds chairs and board seats on a number of industry associations, including the Chair of the Liberty Alliance Policy committee, as well as its eHealth special Interest Group, seats on the Boards of the IT ISAC and the Internet Security Alliance, and the chair of the new ANSI-HITS Panel's Charter and Governance Committee. He is VeriSign's representative to the Industry Executive Committee of the President's National Security Telecommunications Advisory Committee (NSTAC) and has recently been named to the Executive Board of the new IT Sector Coordinating Council, the primary interface between the IT infrastructure community and the U.S. government's Homeland and National Security agencies.

Ed Bostick, MPA

Ed Bostick, *MPA* is working to lay the foundation for region-wide telemedicine networks in Virginia. Bostick's work to improve access to healthcare and education presently includes serving as Team Leader for the Virginia Telehealth Network Strategic Task Force to design the first comprehensive business, technical, marketing and funding plan for telehealth infrastructure in Virginia; serving on the Virginia Joint Commission on Technology and Sciences Emerging Technologies Advisory Board; serving as the Interim Director for a nonprofit telehealth consortium in Virginia that covers 10 counties and includes some of the most medically underserved citizens in Virginia.

His previous accomplishments include directing the High Plains Rural Health Network (a federal, state and foundation funded Telemedicine Project) in the Great Plains and Rocky Mountains. As director of the High Plains Rural Health Network (HPRHN), Bostick secured financing for the development of one of the nation's most successful efforts to promote and implement telemedicine. In 1993, The Colorado Trust extended its grant awards totaling over $140,000 to HPRHN's efforts for the establishment of a region wide consortium of health care facilities. He contracted with a leading telecommunications firm to research and document infrastructure needs and to design a technical plan for a three-state telemedicine initiative to bring specialty medical care to rural areas of the eastern plains of Colorado and western Nebraska and Kansas. He assembled a seven-member team to promote the use of telemedicine to improve access to healthcare. In 1994, HPRHN was awarded a $1,500,000 Rural Telemedicine Grant by the federal Office of Rural Health Policy to develop a teleconsult system linking medical and education experts to rural communities in Colorado, Kansas, and Nebraska. In 1995, HPRHN was awarded a $230,000 Rural Utilities Services Medical Link Grant from the United States Department of Agriculture to deploy additional sites to the HPRHN teleconsult project. Bostick also led HPRHN's efforts to compete successfully for an $800,000 award in the Colorado PUC/US West Reparations Fund grant program to establish a statewide, open architecture medical and education telesystem. This system included the participation of more than 30 medical and educational facilities and was ranked first in overall grant awards from the fund.

Bostick has served as Executive Director of the Institute for Telemedicine in Denver at the Center for the New West; where he sponsored a series of telecommunications symposia to address medical and telecommunication technology adoption of health-related military technologies. Bostick served on the Lieutenant Governor's Telecommunications Task Force to accelerate the roll-out of broadband capabilities throughout rural Colorado.

As a consultant for Nichols, Research, Inc., Bostick helped craft a United States Department of Agriculture, Rural Utilities Services grant proposal to develop CNET telemedicine system for Carraway Hospital in Birmingham, Alabama. Bostick guided the rural health telemedicine application process in Alabama's eastern Appalachia region. This proposal ranked sixth in the nation, overall, for the medical category in which it competed. This project was awarded $285,000.

In total, Bostick has raised over $3,500,000 in grant awards for clients in healthcare, telecommunications, higher education, and the performing arts. He has trained and facilitated medical provider and business groups in marketing, management, fundraising, and organizational development. He has also served on the National Business Coalition Task Force for the National Rural Health Association, a rural health policy advocacy arm of the NRHA. A regular participant in the public dialogue, Bostick participates regularly with task forces, state policy agencies and healthcare providers. Bostick is a speaker at national and regional forums on managed health care, telehealth issues, and telecommunication applications.

Peter Buccellato, BS Engineering and Information Technology

Peter Buccellato, BS is a retired Air Force officer, Vietnam Veteran, Virginia resident and President and Chief Executive Officer of the consulting company, The Knowledge Providers Group (KPG). He holds a Bachelor's of Science Degree and has over thirty-five years experience working within the Engineering and Information Technology arena.

Since Mr. Buccellato retirement from the Air Force in1990, he has held prestigious positions within such companies as General Electric and ECI Systems and Engineering, provided professional guidance, direction, and solutions to business executives within Georgia, Maryland, New Jersey, Ohio, Texas, Washington, Washington DC, and Virginia. His specific expertise resides in Business Development and Systems Acquisition of Information Technology and Telecommunications Systems.

Over the last decade Peter has designed, evaluated systems applications and managed installation of voice, video, and data networks within hospitals, medical imaging facilities and Government medical campuses throughout the United States. Mr. Buccellato has worked in the design, acquisition, evaluation, installation, and testing of picture archiving and communications systems (PACS) to include radiology information systems (RIS), Medication Verification and Documentation Systems, Wireless Communications, Private and Virtual Private Networks (VPN) and worldwide web (WWW) utilization. Mr. Buccellato has evaluated systems, products and applications of such companies as AGFA, GE, Kodak, Philips, Siemens, Cerner, McKesson, Meditech, Medical Manager and IDX and Telecommunication Systems of SBC Communications, Verizon, Qwest Communications, and BellSouth.

Rebecca J. Davis, Ph.D.

Rebecca Davis, Ph.D. is currently the Executive Director of both the Virginia Rural Health Resource Center and the Virginia Rural Health Association. She also serves or has recently served on the following boards and committees: Chair, Council for Rural Virginia; Board of Trustees for the Center for Rural Virginia, Secretary; Governor's Work Group on Rural Obstetrics; Advisory Board of the Rural Health Research Center at the University of Virginia; Virginia Tele-Health Network; Virginia Healthcare Workforce Advisory Committee; Virginia State Planning Grant Advisory Committee; Virginia Steering Committee for the State Plan for Integrating Mental Health Services into Primary Care Settings; Jefferson College of Health Sciences - Physician Assistant Program

Advisory Board; and PATH (Partnerships for Access to Health Care in the New River Valley).

Rebecca holds membership in the Virginia Rural Heath Association, National Rural Health Association, the Association for Career and Technical Education, and is a charter member of the Bath/Highlands Lions/Lioness Club. She has presented at both state and national meetings on rural health and rural development topics. Prior to Rebecca's work in the health care field, she worked in education at both the secondary and post secondary level for 20 years. She holds a Ph.D. in Educational Leadership and Policy Studies from Virginia Tech.

Steve Gillis, MS, Information Systems Technology, J.D.

Steve Gillis, M.S., J.D. has more than 10 years of technical and managerial experience in health information technology, telecommunications and management consulting. He has experience in all phases of information systems development and project management. He has successfully lead cross functional project teams in the design and development of a wide variety of information technology projects. Steve has been actively involved in the VTN since 2003 where he served as Chair of the VTN Infrastructure Work Group, the precursor to the VTN Strategic Task Force. Steve is currently a principal at the Telehealth Solutions Group, LLC (THSG), in Hamilton, Virginia. At THSG, he is leading multiple telehealth and HIT initiatives and is co-principal investigator of a Cooperative Research and Development Agreement (CRDA) with TATRC for commercialization of military medical technology.

Prior to joining THSG, Steve was a senior program manager with Teleglobe Communications in Reston, Virginia. While at Teleglobe, he directed an enterprise wide initiative to migrate Teleglobe's manual product pricing processes to a web based quotation management system. He also managed the design and implementation of telecommunications product support systems. Prior to that, Steve held technical management positions with the Analytic Sciences Corporation (TASC) and the Federal Data Corporation. Earlier in his career, Steve worked with several technology trade associations and consulting firms in Washington DC, where he drafted market analysis and developed trade promotion strategies. In addition to his professional experience, he holds a M.S. in Information Systems Technology degree from George Washington University and a J.D. from the University Of Connecticut School Of Law.

David Heise, BSEE

David Heise, BSEE has more than 25 years of experience in the telecommunications industry. He has extensive experience in all aspects of product development, business analyses, marketing, and sales support for both international and domestic telecommunications services & products. During his career, David has held a wide variety of engineering, product marketing, product development and product management positions. He has overseen the design and implementation of large and complex networks and customer applications (for companies such as JP Morgan, IBM, and Coke).

David has been involved with the Virginia Telehealth Network since 2003. As a member of VTN's Infrastructure Working Group, he was instrumental in the creation of the initial site survey and a subsequent IWG white paper which presaged the VTN Strategic Plan. David is currently a principal at the Telehealth Solutions Group, LLC (THSG), in Hamilton, Virginia. At THSG, he leads the design of telehealth networks and HIT applications. In addition, he is a consultant to MCI, where he supports the development of MCI's state of the art Multi-protocol Label Switching services.

Prior to joining THSG, David was Director of Enterprise Solutions at Sonic Telecom. While at Sonic Telecom he had overall responsibility for development and marketing of advanced video over IP solutions. He was also Director of Transmission Services at Teleglobe Communications. At Teleglobe, he was responsible for the development and marketing of Teleglobe's SONET, ATM, Gigabyte Ethernet, private line products. Earlier in his career he worked in series of increasingly senior positions at MCI. In addition to his professional experience, Mr. Heise holds a Bachelor of Science in Electrical Engineering.

Jay H. Sanders, M.D., F.A.C.P., F.A.C.A.A.I

Jay H. Sanders, M.D. is President and CEO of The Global Telemedicine Group, Professor of Medicine at Johns Hopkins University School of Medicine (Adjunct), and a founding board member of the American Telemedicine Association where he serves as President Emeritus. Dr. Sanders has served on the NASA Biological and Physical Research Advisory Committee, as a consultant to the NASA Space Communication Center and the Scientific Director for the NASA Medical Informatics and Technology Applications Commercial Space Center. He is a consultant to the Army's Telemedicine and Advanced Technology Research Center (TATRC) at Ft. Detrick, and previously served as a consultant to the Air Force Center for Telehealth and Theater Informatics, and was a member of the Department of Defense Telemedicine Board of Directors with the Surgeon Generals of the Army, Navy, and Air Force.

Dr. Sanders serves as a consultant to the Southern Governors' Homeland Security Telehealth Anti-bioterrorism Task Force, and is the Principal Investigator of a grant from the Office of the Secretary of Defense related to First Responder education and standards. During the Clinton Administration he directed the U.S. telemedicine initiatives to the G-8 nations, has been a consultant to the World Health Organization on Health Telematics, and now serves as a consultant to the Russian Telemedicine Foundation. He is a consultant to Vesalius Ventures, a Venture Capital Firm focusing on telehealth, medical informatics, and medical sensors, and was a consultant to Columbia University School of Medicine and their Center for Advanced Technology, and was formerly Visiting Professor at Yale University School of Medicine and Professor of Medicine and Surgery and Director of the Telemedicine Program at the Medical College of Georgia, where he held the Eminent Scholar Chair in Telemedicine.

Dr. Sanders is a member of the Executive Committee of the Board of Directors of the Federal Communications Commission Universal Service Administrative Corporation, and was formerly Chairman of its Rural Health Care Committee. He also serves on the Executive Committee of the Board of Directors of the Friends of the National Library of Medicine. He served on the Southern Governors Association Task Force on Medical

Technology, the FCC Telemedicine Advisory Committee, and the Institute of Medicine/National Academy of Science Telemedicine Evaluation Committee.

Dr. Sanders earned his medical degree from Harvard Medical School Magna Cum Laude and was a member of AOA. He did his residency training at the Massachusetts General Hospital in Boston where he became Chief Medical Resident, and did a research fellowship in Immunology at the National Institutes of Health. Following residency training, Dr. Sanders joined the University Of Miami School Of Medicine where he initiated the concept and established the first Division of General Medicine in any Academic Medical Center. As Chief of that Division, he also headed the Medical Intensive Care Unit, the Medical House Staff Program and the Medical Division of the Emergency Department. He subsequently attained the rank of Professor of Medicine and was Chief of Medicine at Jackson Memorial Hospital, the largest teaching hospital in the Southeastern United States.

Dr. Sanders has spent the majority of his professional career involved in teaching, patient care and health care research. He has spent over 30 years in the development and implementation of telecommunications and information technologies as a means of addressing the problems relating to quality, cost and access to care that now plague our health care system. He designed the telemedicine system for the State of Georgia that interfaces with rural hospitals, public health facilities, correctional institutions, ambulatory health care centers, military bases and public school classrooms. He initiated a project at the Medical College of Georgia that provided the first "electronic house calls" in which patients are cared for in their homes and the elderly in nursing homes. The author of numerous articles on telemedicine, he is an Associate Editor of the Telemedicine and e-Health Journal, Deputy Editor of the International e-Health Journal, and has served on the editorial boards of the Telemedicine Newsletter, Telemedicine Report, The Telemedicine Connection, Telemedicine and Telehealth Networks and Telemedicine and Virtual Reality.

Dr. Sanders is also an editor of the recent book, "Telemedicine: Theory and Practice" a Charles C. Thomas publication. Dr. Sanders is a consultant for many academic, governmental, public and industrial organizations nationally and internationally.

APPENDIX D

Business Case

This icon is a link to the full business case file.

C:\Documents and Settings\c-david.heis